This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

WORKS IN GENERAL LITERATURE.

I.

BLAIR's CHRONOLOGICAL and HISTORICAL TABLES. Extended under the Revision of Sir HENRY ELLIS. Imperial 8vo. 31s. 6d.

II.

LETTERS of WILLIAM III. and LOUIS XIV. and their MINISTERS. Edited by P. GRIMBLOT. 2 vols. 8vo. 30s.

III.

THE SAXONS in ENGLAND: a History of the English Commonwealth till the Conquest. By J. M. KEMBLE. 2 vols. 8vo. 28s.

IV.

CORRESPONDENCE of the 4th DUKE of BEDFORD. Edited by Lord JOHN RUSSELL. 3 vols. 8vo. Portrait, 48s.

V.

THE Chevalier BUNSEN on EGYPT's PLACE in UNIVERSAL HISTORY. Translated by C. H. COTTRELL. Vol. I. 8vo. Illustrations, 28s.

VI.

BISHOP THIRLWALL's HISTORY of GREECE. New Edition, revised; with Notes and Maps. 8 vols. 8vo. £4. 16s.

[*Vols. 1 to 4 already published.*

VII.

MR. ECCLESTON's INTRODUCTION to ENGLISH ANTIQUITIES: intended as a Companion to the History of England. 8vo. Woodcuts, 21s.

VIII.

RANKE's HISTORY of the REFORMATION. Translated by Mrs. AUSTIN. 8vo. Vols. I. and II. 30s.; Vol. III. 18s.

IX.

KEIGHTLEY's OUTLINES of HISTORY, from the Earliest Period to the Abdication of Napoleon. Fcp. 8vo. 6s.

X.

MR. FORSTER's LIVES of the STATESMEN of the COMMONWEALTH of ENGLAND. 5 vols. fcp. 8vo. 30s.

XI.

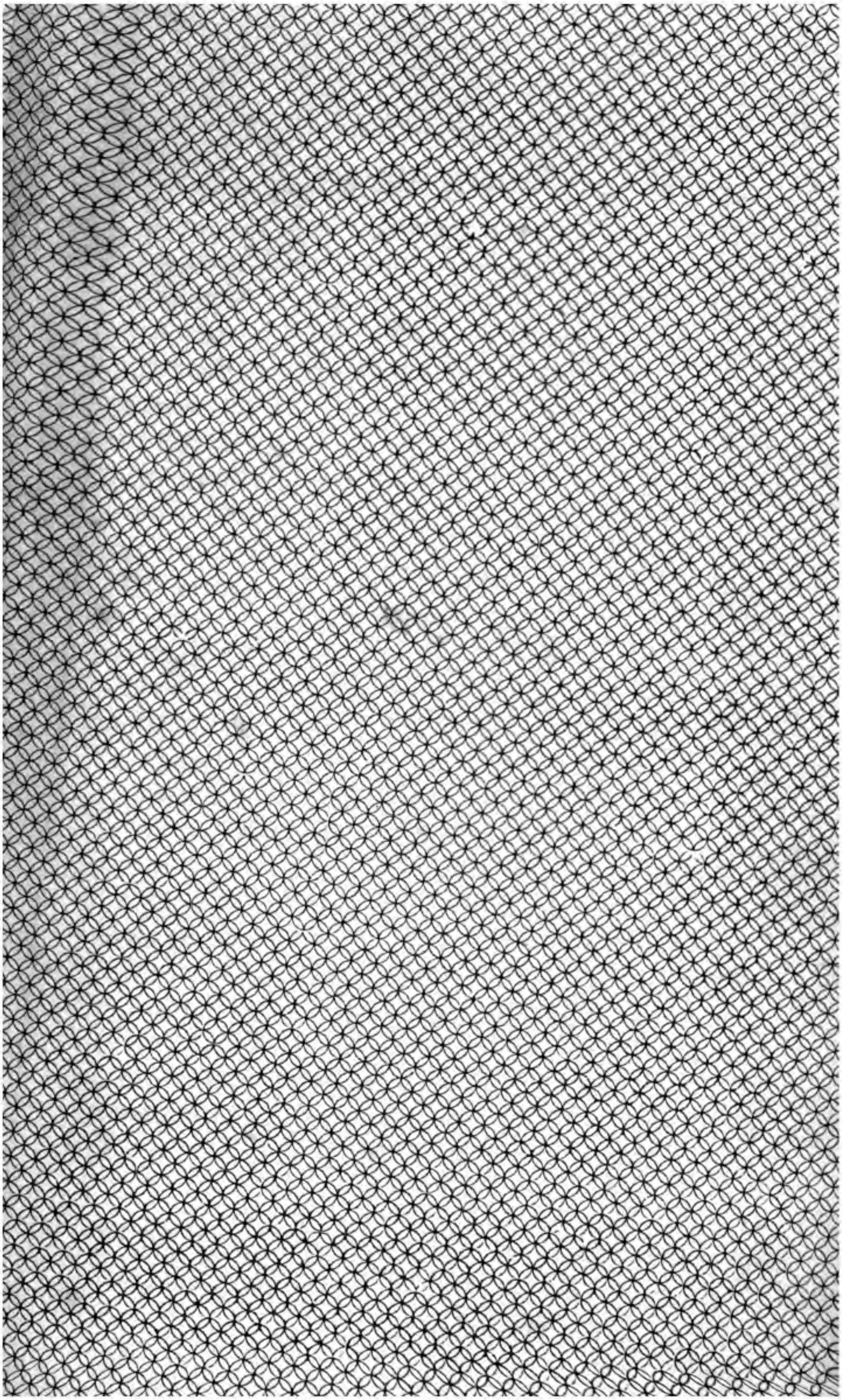
THE HISTORY of ENGLAND, from the Earliest Period to the Year 1760. 10 vols. fcp. 8vo. 60s.

⁂ The History, as far as 1572, is by Sir JAMES MACKINTOSH; the Continuation is by WILLIAM WALLACE, Esq. and ROBERT BELL, Esq.

XII.

SIR HARRIS NICOLAS's CHRONOLOGY of HISTORY, from the Earliest Periods to the Present Time. Fcp. 8vo. 6s.

LONDON: LONGMAN, BROWN, GREEN, AND LONGMANS.



49. 50.

A

PRACTICAL TREATISE

ON

BREWING,

BASED

ON CHEMICAL AND ECONOMICAL PRINCIPLES;

WITH

FORMULÆ FOR PUBLIC BREWERS,

AND INSTRUCTIONS FOR

Private Families.

BY WILLIAM BLACK,

PRACTICAL BREWER.

FOURTH EDITION.

LONDON:
PRINTED FOR
LONGMAN, BROWN, GREEN, AND LONGMANS,
PATERNOSTER-ROW.
1849.

London:
Spottiswoodes and Shaw,
New-street-Square.

Dedication of the Third Edition.

TO

THOMAS GRAHAM, ESQ.,

PROFESSOR OF CHEMISTRY IN THE LONDON UNIVERSITY,

F. R. S., &c. &c.,

This Work is Dedicated,

AS A TESTIMONY OF

HIGH RESPECT FOR HIS PROFESSIONAL ABILITIES,

AND ESTEEM FOR HIS PRIVATE WORTH,

BY

HIS OBLIGED AND FAITHFUL FRIEND,

THE AUTHOR.

PREFACE

TO THE THIRD EDITION.

THE success of two Editions of the Treatise on Brewing, has encouraged the Author to offer to the Public a Third Edition, carefully revised and corrected. A considerable quantity of important matter has also been added, which has had the benefit of being revised by Professor Graham, of the London University, whose eminence in the science of Chemistry is universally acknowledged. In no instance does the Author refer to the opinions of others: all the information which he communicates being derived entirely from his own practical experience, in all parts of the United Kingdom.

CONTENTS.

Page.
INTRODUCTION - - - - - - 1
BREWING - - - - - - - 7
WATER - - - - - - - 7
  As commonly met with in springs - - - 8
  Stagnant - - - - - - - 9
  Running - - - - - - - 11

BARLEY

  Different qualities described - - - 12
  Specific gravity - - - - - - 13
  Temperatures at which germination is destroyed - 13
  Component parts of, and malt - - - 15
  Best for malting - - - - - - 16

MALTING.

  Time allowed for wetting - - - - 17
  How to work on floors - - - - 18
  Drying - - - - - - - 20
  Best mode of drying - - - - 21

MALT.

  How to select - - - - - - 22
  Shipped malts - - - - - - 23
  How to judge of quality - - - - 25

Page.

MALT—(*continued*).
Grinding - - - - - - - 26
When necessary to be re-dried - - - 27
Brown or blown malts - - - - 28
Roasted - - - - - - - 29
ELECTRICITY.
Injurious effects of electro-chemical action on fermentation - - - - - - 30
Paper read to the British Association - - 31
Cases in point No. 1 - - - - - 39
2 - - - - 40
3 - - - - 42
4 - - - - 43
5 - - - - 45
Letter to the Author - - - - 48
BREWERY.
Site of - - - - - - - 49
Coppers, size of - - - - - - 50
Mash-tun, ditto - - - - - - 51
Underback, ditto - - - - - - 51
Coolers, size of and construction of - - - 52
Fermenting-tuns, ditto - - - - - 53
Of metals, such as are generally used - - 54
SACCHAROMETER - - - - - - 56
MASHING.
Further remarks on - - - - - 59
Best temperature for - - - - - 59
No time to be lost - - - - - - 62
Use of hot or cold Water in last mashings - - 64
TAPS.
Produce of, according to barrels turned on the malt - 66
BOILING.
Charring the worts by high pressure - - 71
Long or short boiling - - - - 71

Page.
COOLING.
On the tendency of worts to get tainted in the coolers: its causes and preventives - - 72
LENGTHS AND GRAVITIES.
How to calculate - - - - - - 78
RAW OR RETURN WORTS.
How best to be taken - - - - - 81
REFRIGERATORS.
How to be considered - - - - - 83
TUN ROOM.
Regulators for gyle-tuns - - - - - 85
Best description of, as recommended by the Author - 85
YEAST.
Best mode of preserving - - - - - 88
Best quantities to be used in Brewing - - 89
M. Turpin's theory - - - - - - 92
Professor Liebeg's refutation - - - 93
Whether frequent changes of yeast are necessary or not in the brewery - - - - - 95
Letter to the Author, by Mr. Baker - - 97
Ditto by Messrs. Nash - - 98
Ditto by Messrs. Holt - - 98
FERMENTATION.
Causes of Unsoundness - - - - - 99
Litmus paper an useful test - - - 101
Best temperatures for - - - - - 102
Supposed cause of using over-high temperatures - 102
Regular fermentation described - - - 103
Irregular ditto ditto - - - 106
Inert ditto ditto - - - 107
Boiling ditto ditto - - - 108
Close ditto ditto - - - 109
Long and short ditto - - - 110
Skimming ditto ditto - - - 112

Page

FERMENTATION—(*continued*).

Fretting ditto ditto - - - 113
Yeast-bitten ditto ditto - - - 114
Acetous fermentation described - - - 115
Distillers' Wash - - - - - 117
Further remarks - - - - - 118
Best Malt for Pale Ale - - - - 120
Hops for Pale Ale - - - - - 121
Summer Brewing - - - - - 123
Winter Brewing - - - - - 127
Best mode of Promoting Fermentation when languid from cold - - - - - 129

STOCK BEER.

Best season for Brewing - - - - 130
Slack dried or moist Malt hurtful - - - 133
Want of Success from Locality - - - 133
Drugs - - - - - - - - 136
Heading - - - - - - - 138
Mixing or Marrying Beers - - - - 139
Storing and Keeping - - - - - 141
On the want of Ufiformity in the Quality of Beer 144
Causes of Beer not keeping - - - - 147

FININGS.

Mode of preparing - - - - - 154
How to be used - - - - - 155
Ropiness in Beer - - - - - 157
Hop Dreg in Worts beneficial - - - 158
Grey Beer - - - - - - 159
New Casks, how to Season - - - - 161
Musty Casks, How to Clean - - - - 163
General Summary - - - - - 164

APPENDIX.

Page
Preliminary Remarks - - - - - - 162
FORMULÆ.
For a party gyle - - - - - - 175
Fermentation of the Best Ale - - - 182
Second Ale - - - - - 184
Further remarks on Boiling - - - 187
One Copper Two Boilings - - - - 189
One Copper One Boiling - - - - 194
Ale of twenty-six pounds' Gravity - - - 194
Eight Bushels for Private Families - - 198
Saccharometer - - - - - - 207
Diastase - - - - - - - 208
Spontaneous Fermentation - - - - 215
Reports concerning Beer sent to Calcutta - - 217
Observations on electricity - - - - 219
Atmospheric Electricity - - - - 232
Bavarian Beer - - - - - - 236
Caping on for Small Beer - - - - 244
Of the Colour of London Porter - - - 246
Conclusion - - - - - - - 248

A PRACTICAL TREATISE ON BREWING.

INTRODUCTION.

So many treatises on Brewing, both theoretical and practical, have already appeared, that the subject may very naturally be considered to have been exhausted. Some of these productions, however, are too homely; while others so abound with scientific technicalities, as to be altogether unintelligible to the general reader.

That Brewing is a chemical process, no one can deny, and of course, in every work on the subject, some chemical terms must be used. In the following pages, however, it is not intended to give any account of the production or nature of gases or other chemical agents, further than may be absolutely requisite to elucidate the subject. Nor is it intended to introduce a history of the origin of Beer, which must in a great measure be conjectural.

In most arts, such as dyeing, iron-making, calico-printing, glass-making, &c., great improvements have been introduced by the assistance of chemistry; while the art of Brewing, which may be considered equally important, has remained, to say the least, stationary. This may be easily accounted for. It is well known that many eminent chemists have turned their attention to this subject, and would no doubt have made as great improvements in it, as they have done in other arts, had they been furnished with the same advantages in regard to practical information. This, however, unfortunately has not been the case; for practical brewers, generally speaking, either from self-sufficiency, jealousy, or ignorance, are very unwilling to impart their real or supposed information to any one; but particularly to men of science, whose inquiries excite their jealousy. This in many instances, prompts them rather to mislead than to inform the inquirers.

Another obstacle to improvement is, that almost every brewer in the course of his practice, persuades himself that he has made some discovery, by which he can make his beer better than that of his neighbour. These nostrums, though often worse than useless to the possessors, might, if freely communicated to scientific inquirers, lead to some improvement; but they are invariably concealed, and thus the want of the combination of science with practice, throws insurmountable difficulties in the way of acquiring useful and accurate information. Had it been otherwise, there can be no doubt, that the

Art of Brewing would have been long ago placed, by the assistance of chemistry, on a more scientific footing.

Having had occasion, in the course of a connection of more than forty years with the brewery, to work in premises very differently constructed, we have invariably found, that in each some cause existed which prevented uniformity in the process of fermentation; and until that cause, whatever it might be, was traced and removed, no regular system could be introduced. This sufficiently shows why brewers who go from one brewery to another, cannot arrive at the same successful results with regard to the quality of the beer, although they pursue precisely the same system, and even on some occasions employ the same materials as before. They are thus, from want of chemical knowledge, left completely in the dark, without the possibility of tracing causes and effects. This shows the absolute necessity of applying the discoveries of chemistry, as in other arts, to account for and rectify these anomalies, which without such aid cannot be effected.

The principal object of the following treatise is to trace the causes of these anomalies, and as far as possible to point out the means of removing or rectifying them; and on all occasions to advance only such opinions as are founded on principles strictly chemical and practical, without which, in the present improved mode of research, they can be but of little value; dogmas being now entirely exploded.

Many brewers are highly indignant when supposed not to be thoroughly acquainted with the art of brewing, in every department. We generally find, however, that they who exhibit the greatest self-conceit, are the most ignorant; trusting every thing to chance, and professedly paying no regard either to aromas or appearances of any kind. Strange to say, however, in some instances, such brewers succeed better than those who follow a more scientific system. This may be accounted for on principles which have no reference to any scientific knowledge of brewing. It is possible that their brew-houses may have been, by mere chance, so constructed, as to render their operations less liable to the electro-chemical fluctuations which are constantly going on in the earth and atmosphere, or which are caused by an injudicious mixture of metals connected with their gyle tuns or other utensils. When, however, the said brew-houses must be altered or enlarged as circumstances may require, how often do we find that the chance turns against them, and that by the introduction of different metals, in what is called the new and improved mode of constructing utensils, or from other causes, the quality of their beer is so much deteriorated as materially to injure the trade. It is then only that the self-sufficient brewer begins to discover, that his knowledge of brewing is only superficial, and his process dependent upon fortuitous circumstances, which nothing but a distinct knowledge of chemistry can enable him to comprehend.

It will, therefore, clearly appear, that when alterations are required in an old brew-house, or a new one has to be constructed, the greatest care must be taken to avoid, as far as possible, in the formation of the utensils all electro-chemical agency.

Should the following work be the means of drawing the attention of brewers in general, not only to the injurious effects of electro-chemical action, but also to other causes which prevent successful fermentations, and thus introduce a more scientific and a more uniformly certain system of brewing than has been hitherto established, the Author's object will be accomplished.

It is impossible to describe in writing the different aromas and appearances, so as to make them intelligible, according to our own sentiments on the subject. We have, however, endeavoured to give as much information as possible, in plain, simple language, so as to suit every capacity: but it is only as they may occur in practice, that the different appearances and aromas, indicative of good or bad fermentations, can be described and pointed out; and no one should pretend to possess a thorough knowledge of brewing, until he can at once discover and rectify every thing which happens unfavourable to the desired result, — the production of good, sound, malt liquor.

BREWING.

BEFORE commencing the subject of brewing, it may be proper to say something of the nature of the ingredients used in the manufacture of beer. We shall, therefore, begin with *water*, the most indispensable ingredient.

WATER.

The word Liquor is technically applied in the brewery to water. A great deal more importance is attached to the quality of this indispensable article than perhaps it deserves. Many are of opinion that the difference in the flavour and quality of beer proceeds in some measure from the different substances contained in the water used by the brewer. To this opinion we cannot subscribe, for it is impossible to suppose that any slight difference discoverable by analysis, in the quantities of carbonates or sulphates which may be dissolved in the water, could possibly affect either the flavour or quality of the beer.

Water, as usually met with, contains the following substances, which may, chemically speaking, be called impurities; namely,

Carbonic acid gas, to which the sparkling appearance of pump or spring water is owing.

Carbonate of lime, which is nearly insoluble in water, but which is often held in solution by excess of carbonic acid. When such water is boiled, the carbonic acid in excess is expelled, and the lime falls down, forming the crust in boilers and other similar vessels.

Sulphate of lime: this salt communicates the "*hard*" property, as it is called, to water, and is always known to be present, when soap which is dissolved in it curdles.

Besides these impurities, water always contains muriate of soda (common salt), and often other muriates. By using the term impurities, we do not intend to imply that anything exists in the water, which, when it is drunk, renders it prejudicial: the term simply signifies any substance foreign to the real composition of water. Even rain-water, which is the result of a natural distillation, contains impurities.

Of mineral waters we shall say nothing, as no one could think of employing them in brewing, unless from necessity.

The above mentioned saline substances, we believe, cannot impart any flavour either to the worts or the beer. Carbonate of lime, as above mentioned, is partially separated by boiling, and sulphate of lime may be easily decomposed and the lime separated by a little alkali; as, for instance, by carbonate of soda. We thus reduce the different kinds of water to the same condition, and the products will also be the same.

While brewers and others are continually speaking of the water with which they brew being preferable to any other water, they never think of the difference of the soils on which the barley is grown. Now as the wine from grapes raised on one soil is inferior to wine from grapes produced on another, so every farmer, from experience, will tell you, that such and such soil is not fit for barley; and there can be no doubt that barley grown on certain soils will make inferior malt. In such cases the water used in brewing is often blamed, while the inferior malt, which is the real cause, is blameless.

Stagnant Water.

Many brewers suppose that, by exposing water to the action of the atmosphere for a certain period, they soften it, and make it more fit for the purposes of brewing, and others even prefer stagnant water, even when they have an abundant supply of fine pump-water at command. Exposing spring-water to the atmosphere can do very little harm in winter, and perhaps as little good; but in summer it soon becomes, by exposure, impregnated with filth like stagnant water. Would any one, we ask, after having seen a drop of stagnant water, as exhibited by the oxy-hydrogen microscope, think of using it for brewing, unless from necessity? Yet we have seen people, who were so prejudiced in favour of old customs, as to persist in using it even at considerable expense, and after its baneful effects had been distinctly pointed out, at the same time that they had an abundant supply of fine spring-water always at command, which cost them nothing. There can be no doubt that putrefactive fermentation must at all times, during summer, be going on in all stagnant waters, produced by the falling of leaves, and the depositions of innumerable insects.

This water, we all know, cannot be drunk without prejudice to health; and it is also very unfit for culinary purposes. How then can it be fit for brewing?

In some parts of the kingdom, however, no other water can be procured, and we have seen it impart putrescence to the beer, which could be discovered when smelling or tasting it. In all such cases, the water should be *boiled*, and allowed to cool naturally before mashing; or still better, a quantity of charcoal and lime should be boiled in it, which will, in some measure, correct the putridity. Would the action of chloride of lime be advantageous in such cases?

Running Water.

Running water from rivers or rivulets, although preferable to stagnant water, is still open to some of the same objections, being liable to contain some organic matter. In the first place, we do not know how many different mineral springs may be discharged into it; and in the next place, it is, in summer, liable to be contaminated with the same impurities as stagnant water, although perhaps not to so great an extent.

We shall sum up the whole that may be advanced on this subject, by recommending the purest water which can be found, as fittest for brewing; and by stating that spring-water (not mineral) when immediately pumped up, has the best chance of being pure.

BARLEY.

Any kind of grain can be converted into malt: but in England it is most usual to employ barley for that purpose. There are three species of barley.

1. *Hordeum Distichon*, the common barley, characterised by two lateral rows of seeds on the spike. Professor Thomson's experiments give 0·343 inch as the average length of a seed; 0·143 the breadth; and 0·108 the thickness.

2. *Hordeum Vulgare*, commonly termed *Bigg* in Scotland, having, according to Linnæus, two rows of seeds more distinct, and two imperfect ones.

3. *Hordeum Hexastichon*, with hermaphrodite flowers and six rows of seeds.—Records of General Science, vol. i. 441.

By the experiments of Professor Thomson in 1806, malt of bigg of that year was found inferior to that of English barley by 14 per cent.: the weight of the bigg being 48·848 lbs. per imperial bushel, while the barley weighed 51·444 lbs. From these experiments the excise duty on malted bigg was fixed at 16*s.* per quarter, whilst that on malted barley was 20*s.* 8*d.* per quarter.

Since 1806, from superior knowledge of agriculture, and the selection of improved varieties of the different grains, &c., both barley and bigg have much improved in quality, and have increased in weight per bushel: and it is now the opinion of some practical men, that the best bigg is very little inferior to barley for malting.

In malting barley, the loss in weight is from 21 to 22 per cent. Of this 14 consists of moisture, 1½ disappears during the steeping, 3 on the floors, 3 by commings or rootlets, and the waste 1½. As barley when thoroughly dried loses 6 per cent. of moisture, Professor Thomson considers the actual loss in malting as only 8 per cent.

The specific gravity of barley is from 1·280 to 1·333, that of malt 1·201.

From the interesting experiments of Messrs. Colin and Edwards upon the germination of different kinds of grain, it appears that when wheat, barley, French beans, or linseed, were immersed for a quarter of an hour in water at the temperature of 154° F., the power of germination was completely destroyed; and that water at 122° F. is the highest limit at which it is possible for barley to germinate after immersion.

It is very beneficial to kiln-dry the barley before malting. In the early part of the malting season, when the barley is damp, it cannot be made into good malt, unless thoroughly dried on the kiln. The grain absorbs moisture with greater avidity and regularity, and the process is facilitated. In good seasons, when barley is abundant, of good quality, and of a low price, brewers would find it very advantageous to lay in and kiln-dry a large stock, to be kept for malting the next season. By kiln-drying it will be kept perfectly sound, and will malt as freely or more so than new barley; and should the season prove unfavourable, such provision will be a considerable saving.

By the same valuable experiments of Messrs. Colin and Edwards upon the germination of different kinds of grain, we are led to suggest that the temperature used for drying the barley should not exceed 122° F., while in drying pale malt, the temperature is frequently as high as 160° or 170°. In the Records of General Science, vol. i. 445, Dr. Thomson states that very pale malt may be dried, although the temperature be brought as high as 175°.

The medium, however, through which the heat is communicated, modifies the range of temperature considerably. Thus the seeds before mentioned, if exposed to a temperature of 143° in air containing vapour, or of 167° in dry air, are deprived of their vegetating properties; and when wheat, oats, or barley, had been kept in sand at 113°, they would not germinate. Immersion in water at 167° for 14 seconds destroyed the power of germination. The grains of starch burst at a temperature of 167° according to Raspail.

In the Ann. de Chimie et de Phys. tom. v., Ann. Philos. xii. p. 201., Proust gives the following comparative analysis of barley and malt:

	BARLEY.	MALT.
Resin	1	1
Gum	4	15
Sugar	5	15
Gluten	3	1
Starch	32	56
Hordein	55	12
	100	100

These component parts, however, must differ considerably according to the different qualities of the barley from which the malt is made. Dr. Turner says, "the conditions necessary to vegetation are three-fold; namely, moisture, a certain temperature, and the presence of oxygen gas." The necessity of moisture to this process has been proved by extensive observation. It is well known that the concurrence of other conditions cannot enable seeds to germinate, provided they are kept dry. That the presence of air is necessary to germination was demonstrated by several philosophers, such as Ray, Boyle, Boerhaave, and Muschenbroeck, before the chemical nature of the atmosphere was discovered. Achard afterwards demonstrated that seeds in general would not germinate without the presence of oxygen gas; and his experiments have been fully confirmed by subsequent observers. It has even been shewn by Humboldt, that a dilute solution of chlorine, owing to the tendency of that gas to decompose water and set oxygen at liberty, promotes the germination of seeds.

The late experiments of Saussure (1834) prove that in germination *nitrogen* is always *absorbed.*

The best barleys for malting are those called *mellow* in contradistinction to those which are hard or *steely.* The mellow barleys, generally speaking, are thin-skinned, and when the pickle is divided, either by the teeth or a pen-knife, the kernel is white and floury. The steely barley may also be thin-skinned, but when divided in the same way, the kernel has a bluish cast something like rice. This barley, although equally heavy, or even heavier than the other, will never produce such good malt, nor will the beer brewed from it have the same mellowness or richness of flavour as that produced from mellow malt.

Care should also be taken, that corn of different weights and from different soils, should be kept separate, so as that each different quality may be used *alone.* The heavier barley will generally require to be longer under water than the other, and when mixed will not grow equally on the floors, (an objection usually attending shipped or foreign barley), thus preventing the possibility of making fine malt. It will also be found, that cargoes of barley will never make such fine malt as that bought directly from the farmers. The reason is obvious — the different qualities cannot be kept separate.

MALTING.

Many opinions are entertained as to the best mode of making malt; some persons being great advocates for sprinkling the corn with water during certain stages of the process upon the floors, while others maintain that nothing of the kind is necessary, but rather injurious. As this is not intended for a treatise on malting, we shall not enter into any discussion upon that subject; but shall merely observe, that the practice may be either necessary or not, according to circumstances. In some malt-houses we have found it absolutely necessary to sprinkle for promoting vegetation, while in others, differently constructed, nothing of the kind was required.

The *Excise* allows sufficient latitude for wetting any kind of barley; it must not, however, be less than forty hours under water. The general mode of ascertaining when barley has been sufficiently steeped for malting, is first by its increase in bulk as shown by the dipping rod. A practical maltster generally judges from the compressibility of the pickle when squeezed endways between the thumb and finger. When sufficiently steeped, and after the water has been discharged, the barley is thrown (or in some instances drops through a valve or socket) from the cistern into the couch, where it must by law be let remain undisturbed not less than twenty-six hours, but longer if thought necessary. It is then spread out upon the floor to a thickness greater or less, according to the season and temperature of the atmosphere, at the discretion of the maltster. The rootlets now begin to make their appearance, and great care must be taken to turn the corn occasionally, but gently, so as to prevent any of the fibres shooting out too long, or wiry, as it is technically called. A short bushy root is most desirable. But each variety of barley exhibits different lengths of rootlets. Thus the chevalier is very different from the common barley and the bigg.

No definite rules can be laid down as to how often the floor or piece of malt may require to be turned during the process; this must be left to the skill and judgment of the operator.

Although the law does not permit water to be sprinkled on the corn until after a certain period, when in our opinion it should be no longer necessary, yet the maltster is allowed to sprinkle water upon the bare floor before turning the corn either forward or backward, and this may often be found very beneficial.

Some maltsters have now adopted the thermometer as a sure guide during the process: whenever that instrument indicates an increase of temperature of so many degrees, the malt is turned. This, however, is not a certain criterion. The thermometer will be found a highly useful instrument to guide an inexperienced operator to a certain extent, but it should be used in conjunction with practical skill, else it may do as much harm as good. The humidity of the atmosphere over the malt should be taken into account. The thermometer only shows the *temperature*, a *hygrometer* (Daniel's) would point out the moisture, &c. Quite as much injury is done by turning too often, as by repeating that operation too seldom. An experienced maltster is guided a great deal by the appearance and smell of the corn in process, and also by the increase of temperature. The common mode of judging is by thrusting the hand into any piece of malt, and taking from the bottom a sample. The state of the rootlets of this portion are then examined; if they are running wild, as it is technically termed, or one fibre be protruding far beyond the others — the corn should be turned — if any fœtid smell be perceptible, the same operation is necessary, and also a fresh current of atmospheric air to supply more nitrogen and oxygen to the malt. Mr. Rigg's late publication states that a great deal of carbon must be given out during the germination of the malt. It has been already stated that short bushy rootlets are the best; the great desideratum, therefore, is to preserve these bushy rootlets, which can only be accomplished by proper care and judgment in turning the corn. The skill of the maltster may be always known by this criterion. Whenever the rootlets begin to appear the spire or acrospire begins to shoot up at the back of the pickle, and as it proceeds the barley is converted into malt. The nearer, therefore, that the spire can be brought to the far end of the pickle, without protruding beyond it, the more perfect will be the malt. About the fourteenth day, generally speaking, the malt should be ready to be brought to the kiln—previously, however, it should be gradually made mellow, by gathering it thicker on the floors, so as to come to a temperature of 75° or 80° F. The steep or any water which may have been applied during the process, should have been by this time pretty nearly evaporated, so that the malt may feel dry to the hand.

Drying Malt.

There are various opinions as to the best mode of drying malt, some adopting a long process, and others a process much shorter. If the kilns are properly constructed, and the malt be thoroughly made before being put upon the kiln, twenty-four hours, or perhaps less, will be found fully adequate for that purpose. The greater the quantity of heated air that can be thrown in during the process of drying, the more mellow will the malt be. The best constructed kilns, therefore, are those by which the greatest quantity of heated air can be most quickly introduced. If a great current of heated air be constantly directed through the malt on the kiln no danger of acquiring colour need be apprehended. This current of heated air, however, should be admitted through open apertures, running longitudinally along the furnace fire, on the outside of the Welch lumps of fire-bricks. If, on the contrary, colour should be wanted, it is only necessary, just before taking the malt off the kiln, that all currents of air should be shut off or prevented, excepting from below the bottom of the furnace; a quick fire having been previously made and kept up, any colour may be very speedily acquired. Care, however, must be taken, during this process, by frequently turning on the kiln, to prevent the malt being burnt.

There is a prevailing error, that malt should be frequently turned on the kiln during the process of drying. A little consideration, however, will show the inaccuracy of this opinion. It has been already stated, that when the proper currents of heated air are introduced in drying, no colouring of the malt need be apprehended. We know that the portion of the malt nearest the covering of the kiln sometimes feels quite dry, while that on the top is quite damp; if, therefore, by turning, we throw this part of the malt upon the top and the wet to the bottom, the steam of the wet malt from below must pass through the drier malt on the top, thus creating double work. The steam, also, by again passing through the drier malt on the top, tends to render it tough. If the kilns be properly constructed, turning is not only unnecessary, but injurious, until the malt be nearly ready for removal from the kiln, when several turns, with a brisk fire, may be necessary to render the dryness of the malt uniform; by which, also, the malt will be rendered uniformly mellow.

This, perhaps, may be thought merely theoretical; but the author's own practice as a maltster, and also that of several experienced maltsters, to whom it has been communicated, and by them adopted, will prove the contrary.

Selecting Malt for Brewing.

It is of material consequence to the brewer to have the best malts for the purpose of brewing. Some brewers, when working with inferior malt, think that an additional quantity will compensate for quality. This is, however, an erroneous opinion. Inferior malts can never impart the same mellowness and richness to ale or beer as those of superior quality. From using inferior malt, we also run a risk of having unsound worts. The best, therefore, will be found the cheapest.

Shipped Malts.

Shipped malts, as they are generally termed, are those which have been manufactured in various parts of the country, and from thence sent by sea to London.

Such malts have not, in general, been thought so good, nor have they brought so high a price, in this market as those made at Ware, or in other districts nearer town. The beer when brewed from them was not considered so good, nor thought to keep so well, as that from malts made nearer home, and the country maltsters were not considered to be so well acquainted with their business, and, consequently, their malt did not bring so good a price as that of the others. We are, however, inclined to think that the bad repute into which their malt had fallen did not proceed from any want of skill or care in the country maltsters, or even from any inferiority in the article itself, but from their having adopted an erroneous mode of treating it, immediately after it had been taken off the kiln. They had an idea that by sprinkling it with a little water when it was quite hot, it was rendered mellow, and that this being done before the malt was shipped, caused it to stand out to its measure upon its arrival at its destination, without otherwise in any way injuring it.

Wetting the malt in this way, would not only make it stand out to its measure, but perhaps even produce a little increase in bulk, which was no doubt a great desideratum.

When the malt was used immediately, this treatment might possibly do no harm, further than occasioning some little decrease in the quantity of the extract, the wetting having caused a trifling increase in its bulk, without improving its quality. When, however, the malt so wetted before shipping, was kept for any length of time, it became slack, and the beer brewed with it, as will invariably happen under such circumstances, did not keep, and soon became acid or stale.

This, therefore, was without doubt the cause of the shipped malts having got into such bad repute in the London market. It is to be hoped that the country maltsters have by this time discovered their error, and that they do not now practise the injurious system of watering (or liquoring, as it is called) their malt after its being taken off the kiln. The better price they would be enabled to obtain by the production of a really good article, would more than compensate for the profit arising out of any little increase in measure, which they might have formerly realised by their liquoring.

It might be requisite, however, for some little time, for them to produce certificates that no water had been used previous to the shipment of the malt.

How to judge of Quality.

In buying malt, a good judge, on taking up a handful, examines narrowly the different pickles, to ascertain if the spire be well grown, that is, at least, two-thirds up the back of the pickle; he also looks for sleepers or dead corns which have not sprung at all. Should there be many of these, he will probably reject the malt. But a mode of judging of malt which is very good, is one that is old and simple. Count out indiscriminately from the bulk about 200 pickles; throw them into a tumbler of cold water and stir them; the pickles thoroughly malted will float horizontally on the surface, those half-malted will float vertically, one end hanging down, and the unmalted will sink to the bottom. We can thus at once form an accurate estimation of the quality of any malt.

The next thing we have to attend to is the weight of malt. Barley, in the process of malting, loses rather more than one-fifth its weight, the malt consequently should be lighter in the same proportion than the barley from which it is made. Some time ago about 40 lbs. per bushel was thought a maximum weight for malt, and many would not have bought it if above that weight. Now, however, from superior culture, the quality of barley has been very much improved, and fine samples may be found weighing 56 or 57 lbs. per bushel. The finest malt from such barley will weigh about 43 or 44 lbs. per bushel; and if it be really all malt, its value may be determined by its weight, the heavier malt always yielding the greater produce. Still the final criterion must be the specific gravity of the worts as determined by the hydrometer or saccharometer. There are fewer husks proportionally in heavy than in light malt; and according to the weight and paucity of husks will be the extract in the mash-tun.

Malt of 40 lbs. weight per bushel should yield from 80 to 84 lbs. gravity per quarter by Long's instrument, or from 220 to 233 specific gravity by Allen's or Bates's saccharometer. Good malt, however, if above that weight, will be found to produce more than the other, in proportion to the difference in weight, and is of course of greater or less value accordingly. In Ireland, all malt is sold by weight, 168 lbs. being allowed for a barrel, and it would perhaps be as well for the buyer, if the same method were adopted in this country.

Grinding Malt.

Whether malt gives the best extract when ground with stones, or crushed with rollers, is undecided. We have seen this point put to the test. From the same bulk of malt, equal quantities were taken, and the one ground with stones, the other crushed with rollers: these were mashed in separate tuns for the same brewing: the difference in produce, however, was so trifling, as to make it a matter of little importance which was used. Perhaps grinding will yield a little more from coarse imperfect malts.

Many brewers think, if the pickle is at all broken, it is better than finer grinding or crushing. These, however, attach immense importance to the brilliancy of the first tap or wort. If the extract be thoroughly made, as will be afterwards explained, the brilliancy of the tap is of little consequence.

Malt, when ground, should never be allowed to remain in sacks, or be in any way exposed to the atmosphere. From exposure it imbibes moisture, and hence acquires acidity. We have invariably seen tainted or unsound worts produced from malt thus exposed.

Kiln-drying Malt.

All brewers who make their own malt, have kilns always at hand; and there can be no doubt that every brewer who can command the means, ought to make his own malt: he can then at all times so modify the colour and flavour, as to produce in his beer those which are most desirable to his customers. When the brewer is necessitated to purchase instead of making his malt, it is in all cases very desirable that he should have a kiln in his premises, for the purpose of re-drying malt which has suffered injury by exposure to the atmosphere, or by imbibing moisture during a sea voyage. Such malt, if used without re-drying, will invariably produce unsound worts, and consequently bad beer; but if re-dried previous to mashing, the beer will have a fair chance of being good. Malt absorbs moisture very readily, and loses colour by keeping and exposure to light. Re-drying in such cases will be found a very simple and useful method of producing sound and well-flavoured worts, and should never therefore be omitted by the brewer. Maltsters generally tell you that the re-drying of malt spoils it. It undoubtedly spoils their own profits by reducing the bulk, but certainly not the malt — an additional price would therefore be necessary to reimburse the maltster for re-drying.

Brown Malt.

Brown, or, as it is commonly called, blown malt, is usually made for porter-brewers, by applying a very strong heat to the malt immediately when put upon the kiln. This is done by means of faggots of dry, hard wood, commonly beech or birch; fir imparting a tarry taste. This process occupies only a few hours. The malt is spread very thin, and derives the name of blown, from the extreme heat separating and blowing out the husk from the kernel, so as to make the pickles appear of much greater bulk than they would otherwise be; thus producing perhaps 32 per cent. less extract than malt dried in the common way.

We are of opinion, however, that high dried, close amber malts, are better than blown malts in every respect. These are dried in the common way, the colour being thrown in without blowing, by a brisk fire of dry hard wood, just before being taken off the kiln, as already described.

Blown malts are now comparatively but little used; they are generally made of the worst barleys, and although bought at a much lower price, are very unproductive. Both colour and flavour can now be given quite as well with the best roasted malt, but great care must be taken in the selection of it. A great deal of it *also* is made from the worst malt, and often with a mixture of barley; and if such be used, it will give neither the requisite flavour nor colour. Some of it also is too much carbonised or roasted, which imparts a disagreeable roughness to the beer, without the other requisites. It should therefore always be bought from respectable houses, who, although they must charge higher prices, will not attempt to deceive. There are many respectable houses in and about London who now make roasted malt, from among whom we shall particularise three, for the information of country brewers, who may not otherwise know where to apply, viz., Mrs. Backhouse, Coxe's Square, Spitalfields; Messrs. Howel & Co., Queenhithe; and

Mr. H. B. Walmsley, 24, New Road, Mile End;—all in London.

About five per cent., or one quarter in twenty of well-made roasted malt, with well-cured pale malt alone in the grist, will generally be found sufficient, or rather less if used with a mixture of high dried close amber malts. As the grains are sometimes objected to by the cow-feeders when the roasted malt is used in the mash-tub, it will answer equally well when thrown into the copper, where the quantity can be easily adjusted to the colour required.

ELECTRICITY.

On the injurious influence of Electro-chemical Action in the Process of Brewing.

It is now admitted that electricity is a powerful agent in all processes both natural and artificial. Wherever heat is liberated spontaneously in any process, it must proceed from one or more of the substances employed, acting upon others of a different nature; and when heat is thus produced, it may be supposed to proceed from chemical action, and thus evolving electricity.

Fermentation is a process of this nature, and the production of alcohol may be said to be partly effected by galvanic or electric action. Although fermentation has always been considered a very uncertain operation, and subject to every fluctuation of weather, we entertain some doubts upon that subject, and are also inclined to think that the causes influencing fermentation are not so little under control as may be generally supposed. If alcohol be the production of a regular chemical action during the process of fermentation, by disturbing the progress of that action, we will no doubt materially interfere with the results. If we find that in certain situations, and under certain circumstances, fermentation goes on much more regularly and uniformly than others, while using precisely the same kind of materials, we have a right to suppose that the want of uniformity must proceed from causes, which may be traced and removed. That the direct application of common electricity or voltaic electricity materially affects fermentation, there cannot be the slightest doubt; indeed it is established by several undeniable facts.

We shall, however, in the first place, insert an abstract of a paper on this subject, which was communicated by the author, to the British Association at their meeting in Liverpool, in 1837.

"I trust I may be excused in drawing the attention of the meeting of the British Association to a short notice of the injurious influence which electricity exerts on the fermentation of the worts of the brewer and the wash of the distiller. The powerful and injurious effects produced by this agent in the manufacture of beer, I endeavoured to point out, in a little work, lately published, on Brewing ; which, although it has excited some notice among a few practical men, yet the subject has not received that attention which its great importance deserves. But I entertain a hope, that this matter will stimulate some members of the Association minutely to examine the nature and extent of the electrical agency, and, by well-devised experiments (towards which, if required, I should most willingly give any information or assistance,) succeed in convincing brewers and distillers of the necessity of studying the laws which regulate this all-powerful agent, in order that they may avoid its injurious effects in the manufacture of beer or spirits. Beer, to the industrious classes in this country, may be considered a necessary of life; and its wholesomeness and purity must, therefore, be of vital importance. The quality varies exceedingly in different parts of the kingdom, and what is considered good beer in one district, may in other parts be pronounced *execrable.* One great cause of the inferiority of beer and ale in the country, and of the great diversity of flavour, is the want of competition ; it being only in the large towns that effectual competition exists. In the country districts there is little or none. The brewers have been long in the habit of purchasing all the public-houses in their neighbourhood, and these houses being limited in number, the labouring classes are prevented from selecting their own beverage, and have no choice but to drink that of the proprietors of the public-houses, who are also the brewers. Most of such beers are very imperfectly manufactured, and are usually foul and yeast-bitten, and have a very disagreeble, rank bitter, derived from the yeast left in the beer, instead of its being thrown out by a proper process. This bitter, although often mistaken for it, is very different from the agreeable and aromatic flavour of the hop. Yeast-bitten beer is particularly injurious to wet-nurses in the suckling of infants. In some districts, unsound, stale beer is the favourite beverage; so that, from long use, good, sound beer would not be appreciated, but rejected. A frequent cause of such inferior beers proceeds from want of proper attention being paid to cleanliness, which produces tainted worts, and consequently bad fermentations. I suspect, however, that it very often proceeds from electric or galvanic agency: the fermenting vessels, being very frequently sunk in the ground, are particularly liable to be affected by all electrical and atmospherical changes, as I have had many opportunities of observing. It is to the latter that I wish to direct the attention of the meeting. It has long been familiarly known, that thunder sours beer; but, though generally known, very few brewers have inquired into the cause, or adopted means to prevent this atmospheric, or other action, affecting beer during thunder-storms, or in the different electric states of the earth and atmosphere. The extreme rapidity with which the electricity is evolved during a thunder-storm, is strikingly exhibited in a distiller's fermenting back. These fermenting backs are often made of cast iron, and either fixed in the earth, or connected with it by an intermediate iron vessel, employed in regulating the temperature. A very short time after a thunder-storm begins, or when the atmosphere is highly charged with electric matter, the appearance in the back altogether changes. The usual healthy character of the fermentation disappears; and it is now attended with a hissing noise and frothy head: and when samples are drawn and examined, is found to have risen, instead of fallen in gravity many degrees, and to contain 5 per cent. or more, of acid. Under these circumstances, the distiller has no alternative but to run off his wash into the stills, although they may be as high as 10 or 12 degrees above water, or occasionally of much higher gravity.

" But the chemical agency exercised by a highly electrical state of the atmosphere, is not confined solely to the fermentation of vegetable substances; it affects even the smelting of iron. It is well known to iron-masters and smelters, that in certain conditions of the atmosphere, and particularly during sultry summer weather, they can never, with certainty, calculate upon producing good, soft, tenacious iron, technically called No. 1.; it is much more generally the white, hard, inferior kind, called No. 3., or a mixture of Nos. 2. and 3. Now, in such circumstances, it will be found that the iron was melted during a thunder-storm, or when the air was highly charged with electricity. In these cases the ore shall be of the best quality, and all the manipulations belonging to the melting be carefully looked after, and even a much greater charge of coke be employed (the *dernier resort* of the melter), when apprehensive of hard, inferior iron, yet, notwithstanding all these precautions, the yield of iron is of the quality No. 3. The operating cause we consider to be electricity. The result of my observations, in different parts of the kingdom (and they have been pretty widely extended), is, that where the fermenting tuns have been placed upon baked wooden bearers, and supported upon brick or wooden tiers, or columns, and every other precaution used to insulate the vessels as much as possible, the fermentations proceed regularly and progressively, and the beer turns out good, bright, and sound, and will keep so; but when the tuns are placed on, or embedded in the earth, or when electric action is induced by a chain of copper or metal pipes, making a complete galvanic circle, the fermentations are very irregular, and do not go through their changes in anything like order, and show only extremely high, light, and puffy heads. Frequently the attenuation or decrease of specific gravity altogether stops; and the beer becomes sour, or partially unsound, before leaving the fermenting tun. A rather singular attendant on this galvanic action in the fermentation is, the rise of the temperature of the worts in the fermenting tun will, in the course of one night, be 10 or 12 degrees, or more, and without a corresponding attenuation; while, in all healthy fermentations, there is a regular and proportioned decrease of gravity for increase of temperature. This is a point (although at present very little known or attended to) of the utmost consequence in regulating the proper quantities of yeast to be employed as a ferment, according to the specific gravity of the worts, and quality of the beer to be produced. A great deal of attention has of late years been bestowed on the mechanical construction of the utensils employed in breweries, in order to diminish manual labour and the waste of beer, and in making them quite *automatic.* In these improvements, unfortunately, too little attention has been paid to the injurious action of galvanism, or electricity. We know of one exception. An extensive establishment in London, well aware of the action induced by electricity, took the wise precaution, a few years since, when erecting fermenting tuns, containing 1400 barrels each and supported by iron columns, to have them insulated, from which they have derived great benefit. The same house, sensible of the importance of observing the atmospheric changes, has kept a meteorological journal for the last ten years; the observations being made three times a day — at four o'clock A.M., at nine oclock A.M., and at three o'clock P.M. In order to prevent the electric action on the fermentations of beer or wash, the vessels should be thoroughly insulated, and the mains, or pipes, leading to or from these vessels, should be thoroughly disconnected from them, by means of union screws, or perhaps still better, by a short hose of leather, or caoutchouc, or Indian rubber. By these simple means, the galvanic circle, otherwise formed by the metal pipes and cocks, &c. employed in removing the worts, refrigerating, or cleansing, will be broken, and a uniform, regular, and healthy fermentation, be produced. I have been inclined to think, that the great difference in the quality of wines which we read of, produced from vineyards within a short distance of each other, may as often be traced to some electrical action, caused by a bad arrangement of the fermenting vessels, as to any difference in the soil or quality of the grapes. I hope these few observations, brief as they are, will draw the attention of men of science, and also of the manufacturer, to the subject, believing it one of primary importance in this branch of the chemical arts."

Mr. Faraday and Dr. T. Thomson considered the above suggestions particularly worthy of the attention of brewers and distillers.

We know that thunder-storms are caused by the different electric conditions of the earth and atmosphere. Fermenting tuns may be so situated, as to be affected by these different electric conditions. We know that milk in some dairies is soured and injured by atmospheric electricity, while in others differently arranged, no such effect is produced. Most brewers will admit, that beer of the same brewing, when sent out in casks, will remain sound in the cellars of some of their customers, while in others it will become acid.

A shock of electricity sent through any beer will speedily cause it to become sour.

Fermenting tuns, when imbedded in the earth, are very liable to be affected by the various conditions of atmospheric electricity.

Many instances of injury, from such causes, have come under the author's observation, from which he selects the following:

In the summer of 1828, being called into a town in Surrey to superintend some brewings, he found that the fermenting tuns were imbedded in the earth, and at once expressed his disapprobation of this mode of placing them, and at the same time his doubts of any certainty of success, until the tuns were differently situated. No change of position could, at that time, be made. The fermentations, however, although by no means right, went on indifferently well for several brewings. But in a brewing, which was made on the 2d of July, the fermentation the next day (the 3d) became quite stationary, with regard both to temperature and attenuation: and although all the usual means were resorted to, none had the desired effect of forwarding the process. Having previously seen the same cessation of fermentation in an electrically excited state of the atmosphere, he had no doubt but that the extraordinary results proceeded from electric action, and stated his opinion to that effect to the brewer and others, at the same time predicting that we should very soon have a thunder-storm. As it is generally considered hurtful to let beer remain in the gyle-tun in a state of total inactivity, it was immediately cleansed by pumping it from the gyle-tun, into casks placed upon wooden stillions about eighteen inches high, where it soon began to throw out its yeast very well, and at the same time underwent an attenuation of 6 lbs. per Long's instrument. Early the same evening a thunder-storm came on, which was of unusual violence.

The fact of beer of the same brewing turning out so differently in one cellar from another, is too well known to require any remark. It may often be owing to the same cause as the suspension of fermentation in the imbedded gyle-tuns; for when the casks are placed directly on the ground, without wooden bearers or stillions, the beer contained in them is more liable to electrical fluctuations than when the casks are better insulated.

The next case is of a different nature, and depending upon voltaic action. In 1835 some parties who had lately taken a small brewhouse near London, were surprised at the rapidity of their fermentations in certain stages; and also at the height to which the light yeasty or frothy heads rose at the same time. The author was applied to, and found that the gyle-tuns were lined with metal, which he then supposed to be lead, as is usual in such cases. A brewing was made for the purpose of ascertaining what was wrong. The worts, when gathered together, were 27 lbs. gravity per Long's instrument, and were originally at a temperature of 58° F. in the gyle-tun, when a moderate quantity of yeast was applied. The fermentation advanced pretty regularly until about eight o'clock next evening. It had then advanced to a temperature of 62°, having a light yeasty head, and rather unusually pungent odour; it had also attenuated 4 lbs. in gravity. At six o'clock next morning it had attained a temperature of 78°, which is very unusual in so short a period. The light yeasty head having fallen a little during the night, was again rising, presenting a bluish-white appearance, which always denotes unsoundness; the gas was smotheringly pungent, and the beer had a very unusual styptic subacid flavour.

Calculating from the temperature gained (see chapter on Yeast) it should have been attenuated down to 7 lbs. It was only, however, at 14 lbs. The author concluded that the process had been improperly interfered with, and stated his opinion to the parties concerned. He was, however, assured that nothing had been done but by himself, and that every previous process had gone on in the same way. When the beer was cleansed, the tuns were again examined, when it was found they were lined with sheet copper, and soldered at the joints with tin. There was also a brass cock for cleansing the beer: so that two or three metals were in contact with the worts. On tasting the different beers in store, they had all a styptic, subacid flavour, such as had been perceived in the gyle-tun, which had, indeed, been the great cause of complaint. By some oversight the beer was not *tested* chemically for copper or tin, which doubtless would have been discovered in the beer.

A new wooden gyle-tun being recommended, it was immediately procured and placed as directed. In this tun no further difficulty occurred, the fermentations went on regularly, and the beer turned out well.

The previous irregularity and styptic taste must, therefore, have proceeded from a portion of the metals being dissolved by the galvanic action, a necessary consequence of the mixture of metals in the gyle-tun.

In the next case which we bring forward the gyle-tuns were old and lined with lead. The worts ran from the coolers into the tuns by a leaden pipe introduced into the middle of the tun through the leaden lining. The tuns were also connected with a short main pipe (for cleansing the beer), by means of brass cocks and solder. The fermentation here was excessively irregular, sometimes going on very rapidly,—and ultimately arriving at what is called the "boiling" appearance, described in another part of this treatise: at other times coming almost to a stand still; and on all occasions after a certain stage of the process, acquiring an unhealthy faint odour. To prove to the parties that these irregularities arose from the mixture of metals in the gyle-tun and connected with it, two barrels of wort were taken and fermented in an open-headed butt, where the fermentation went on quite well, and without any irregularity whatever.

New gyle-tuns were at last ordered and put up; but even then some little irregularities were perceivable, which were discovered to be owing to a different mode of conveying the worts (through pipes from the coolers to the squares) from what the author had recommended.

This having been altered, the brewings proceeded favourably, and no further irregularity in the fermentation occurred. The beer was approved of, and pronounced to be as good as any of the same gravity by two first-rate practical brewers in London. This shows what apparently trifling circumstances influence fermentation, where galvanism or electricity is concerned.

The next case we adduce differs from any of the preceding. Here there was no metal within the tuns, but brass cocks alone. There was a long leaden main pipe extending through and round the premises, in length, altogether, perhaps above 100 feet. In this main pipe there were various brass stop cocks, for different purposes. All the gyle-tuns were connected with this main by means of other pipes and brass cocks, for drawing off the beer for cleansing, thus forming a galvanic circle.

The complaint was, that the fermentations were all wild and irregular, and under no kind of control. The beer consequently was very much complained of, and invariably unsound. Two of the gyle-tuns were placed directly opposite each other, and connected as above described, with the main. When both these were charged with worts at the same time, the progress of the fermentation was certainly very extraordinary.

When fermentation had fairly commenced, and all other parts of the top were covered with the creamy froth, a circular space about eight inches in diameter, remained quite bare, directly above the discharge-cocks in both tuns. As the fermentation advanced, these were covered like the other parts.

The frothy top now rising, began to assume a variegated appearance. Directly above the discharge-cocks, that glassy-looking, bluish-white appearance, was perceptible, which always indicates unsoundness or galvanic action. This appearance gradually extended in a circular manner, about half round the tuns, in different directions, so as to form two opposite semi-circles. Soon after, the heads rose to such a height as to run over the top of the squares, without the possibility of preventing or controlling the action. The first thing done was to cut off the communication between one of the tuns and the main pipe. This had at once the desired effect. The fermentations in this tun were regular, and perfectly under control, and the ale produced proved very good. Notwithstanding this instructive fact, it was some time before the parties could be prevailed upon to cut off the other communications in the same way. They persisted for some time in brewing their common beer in the two tuns above mentioned, and the results were uniformly bad. Had the author's suggestions been followed, every thing might have been remedied in a few days, as was afterwards proved, by cutting off the other communications between the tuns and main pipe.

I have thus given a few instances, out of many which could be adduced, of the decided and injurious effects of electricity, whether common or voltaic, exhibited during the progress of fermentation: effects which, when well understood, may be easily obviated or corrected.

The experiments of Gay Lussac also clearly prove the important agency of electricity in the process of fermentation. He found that wort to which yeast had been added, when placed in a vacuum, did not undergo fermentation, although all the circumstances were favourable excepting the presence of oxygen. But when an electric spark was passed through the fluid, the fermentation commenced vigorously. The effect here produced, he considered, was by the electric spark decomposing an atom of water, and thus liberating an atom of oxygen, which caused the process to begin. We do not mean to question the high authority of Gay Lussac, but his experiment does not altogether prove that the particle of oxygen produced was the cause of fermentation. It might perhaps be owing to a more general influence of the electric spark, which, in passing through the fluid, induced such chemical action of the different component parts upon each other, as were sufficient for producing fermentation.

We shall be able to prove, that after the process of fermentation has fully commenced, galvanic action will promote a much greater excitement than is desirable for the vinous fermentation; and we are also inclined to think, from the effects produced, that the acetous, instead of the vinous fermentation, is partially going on, or it might be better to say, that acidity is produced by voltaic action. M. Gay Lussac has distinctly shown, however, that a considerable excitement is produced by the electric spark, so as to occasion too vigorous fermentation, and we hope that very eminent chemist, by still continuing his attention to the same subject, may further enlighten us as to these results.

Having pointed out some of the errors most frequently committed in the construction of brew-houses, by the introduction of pipes consisting of various metals, (which we think has been proved to prevent the possibility of regularity in fermentation,) we shall now, in illustration of our remarks on electro-chemical action, describe a brew-house, in which there is neither a pipe nor pump, and in which every operation has gone on regularly and uniformly for years; and that also without a change of yeast.

We are inclined to believe that the locality was in a great measure the original cause of this brewhouse being so constructed; and that it was thus advantageously built, more with the intention of saving money and labour, than from any knowledge of electro-chemical agency. This brewhouse is situated at a place called Pen-y-Bryn, in the immediate neighbourhood of Llangollen, a post-town on the great road between London and Holyhead. It is placed at the bottom of a hill, on a sort of slate rock, and is supplied with water from a fine spring, on the side of the hill far above the brewhouse; thus giving a complete command of water, without pumping. Advantage has also been taken of the sloping of the rock, so as to save all unnecessary building. There is at the top of the premises a copper placed for the purpose of boiling the water used for brewing. Under this copper, at a little distance, is the mash tun, (commanded by this boiler,) from which the worts when ready are allowed to run directly into the wort-copper, which is at a little distance below the mash-tun. There is no underback. The wort-copper is sufficiently high to command the coolers, from whence the worts run into the gyle-tuns through canvass hoses and wooden shoots. And directly under the gyle-tuns is the cleansing room; so that neither pipe nor pump is necessary in the whole concern, excepting a short leathern hose for cleansing.

All this has been done by cutting away parts of the rock, so as to leave sufficient declivity for the different compartments.

Mr. Berry, the proprietor of this concern, adopted our system of brewing in March 1836, when he first commenced brewing there; at which time, we expressed the highest approbation of the construction of his premises in every department, and our opinion that nothing but want of care could prevent his being successful in his operations. We here subjoin an extract from a letter received from him, dated the 8th of July, 1839:—

"My Dear Sir,

"I feel much obliged by the compliment you intend passing on the construction of my brewery in your coming publication, and shall be much pleased if I can in any way benefit you by proving the success of your method of fermentation, from which I have never varied. With the exception of the small quantity of yeast you brought about eighteen months ago from London, I have had no change since the first commencement here, 9th March, 1836. I am to-day brewing from the same store, and my gyle-tuns work entirely to my satisfaction. With the exception of a chance cask or two, not being sweet, I have not had a single cask returned for any fault the last two years.

(Signed) "C. C. Berry."

Many other certificates of a similar nature can be readily furnished.

This distinctly shows that success in brewing depends, in the first place, very much on the construction of the brewhouse and utensils. When these, therefore, are properly constructed, and a correct system of brewing has been introduced and persisted in, nothing but want of attention or bad materials (such as defective malt and hops) used in brewing, can prevent unvarying regularity in the process of fermentation, followed also by unvarying uniformity in the quality of the beer.

Since our last publication it has been ascertained, that when placed in a negative vessel, worts will remain sound for a much longer time than when put into a positive vessel.

But when the gyle-tuns are in a negative state, the fermentations will go on very languidly, and occasionally become quite stationary; while on the contrary, under a different state of electro-chemical action, they will go on violently and uncontrollably, but without the due attenuation.

THE BREWERY.

Site and Construction.

An airy unconfined situation should, if possible, always be selected for the site of a brew-house, so as to admit of a free current of air round the coolers.

In building, the boiling and mashing departments ought to be kept separate from the cooling and fermenting departments. This arrangement will prevent the steam retarding the cooling of the worts, and also from coming into contact with the fermentations, which has often an injurious effect.

If a current of steam be directed over a gyle of beer in a vigorous state of fermentation, the head will very soon drop. If a fermenting tun be placed directly under an iron-jack or hop-back, on the boiling worts being turned into the jack-back, the head on the worts, however vigorously going on, will very soon drop.

Size of Copper.

The size of the copper or coppers and mash-tuns must be proportioned to the quantities of malt to be brewed.

Where there is but one copper it is much better that it should be too large than too small, as a large copper gives much greater facility in going on with the process, and also often enables the brewer to boil all the worts at once; thus saving both time and fuel. The copper should, therefore, contain from four to five barrels for each quarter of malt to be brewed; or say for 10 quarters, 50 barrels, and so on. By inserting a damper in the flue, say about

18 inches above the crown, any copper can be made to boil 10 barrels or less, without injury to itself. This damper being shut, and another opened higher up, the copper becomes serviceable to its full extent. We have seen a copper containing only 42 barrels for mashing 18 or 20 quarters of malt: this caused such delay in the process, as was often very injurious. There was no occasion to brew more than eight or nine quarters at a time, which could be done well and safely; but it was with the greatest difficulty that the proprietors were persuaded to adopt that alteration, and it is doubtful if they altogether now adopt it.

Size of Mash-Tun.

The mash-tun should contain nearly four barrels for every quarter of malt to be brewed. This enables us to turn on a sufficient quantity of liquor for making a large extract in the first mash, which will be found the most beneficial mode of brewing every kind of beer. We do not, however mean that a large quantity of liquor should be turned on at first. — *See* MASHING.

The under-back must be proportioned to the mash-tun. In some newly constructed brew-houses there are no under-backs, which is a great improvement. The liquor boiler and mash-tun are placed high enough to command the wort-copper. The worts then run directly from the mash-tun into the copper (*see* page 47.). It is certainly the best construction that can be adopted, as it not only saves time and labour, but also prevents the possibility of the worts getting tainted between the mash-tun and copper; which sometimes happens by lying too long in the under-back.

Coolers.

Where there are no refrigerators, the coolers should be spacious, and so constructed as that the worts may be run from the one into the other, which very much facilitates cooling; and where there are no artificial means of cooling, the coolers should be of such dimensions as to prevent the necessity of the worts being at an average more than two inches deep; or two and a half inches at the utmost. Blowers or fans are very useful, as they not only facilitate the cooling of the worts, by sweeping off the fob or froth, thus allowing a free radiation of caloric, but also by keeping the worts in constant motion, they assist in preventing their becoming tainted. Refrigerators are now very much used. We have lately, however, been inclined to think, that when improperly constructed, they sometimes occasion a little faintness in the worts by galvanic action, although the injury may perhaps as frequently arise from want of cleanliness. Our opinion, however, on this subject will be more fully expressed under the articles Refrigerators and Regulators.

Fermenting Tuns.

The fermenting or gyle-tuns should be of sufficient dimensions to contain the worts, and leave at least six inches of the depth unoccupied : they must also have on the top a sufficiency of what is called *lubber boarding* or frame work, for the rise of the head during fermentation. After what has been said upon electro-chemical action, it is almost unnecessary to add how the tuns should be placed; they should of course be isolated as much as possible, and in no way connected with the earth, either by pipes or otherwise. If main pipes must be had for cleansing, the gyle-tuns should be detached from them during the progress of fermentation. When ready for cleansing, they may again be connected by union screws and pipes. Long chains of pipes connecting different vessels together, must be injurious in every case, as they will be found to produce electro-chemical action.

The chains of pipes now so frequently employed in cleansing, for the purpose of saving labour and waste of beer, although not so injurious as during fermentation in the gyle-tuns, may nevertheless be found prejudicial to a certain extent. The old mode, therefore, of cleansing with leather hoses (or pipes), although more troublesome, will be found safer, as far at least as regards perfection in beer.

Several plans might be suggested of getting through the process of cleansing as quickly and with as little waste as by long chains of pipes.

Of Metals, such as are generally used in the Brewery.

It is now beginning to be admitted by many well-informed brewers, that metals, generally speaking, had better be dispensed with in the brewery, in all cases where their use can possibly be avoided, as they find that they often tend to injure the beer, particularly in the coolers and tun-room. As some metals, however, are more detrimental than others, it may be well to point out such as ought particularly to be avoided on account of their injurious effects.

All salts of lead or of zinc are poisonous, and should, therefore, be avoided in every department of the brewery. Lead becomes oxydized, in the presence of carbonic acid and stale beer, and should not, therefore, be allowed to come in contact with either in the brewery. Zinc also, in many cases, may be found very detrimental. All salts of copper are also poisonous; but when vessels of this metal are kept clean, as in coppers or boilers for water or worts, they are then not found to be injurious; but they should always be kept well scoured and bright. All salts of iron are harmless, if not used in excess; iron is, therefore, the safest metal to use in the brewery, where metals cannot be dispensed with.

Copper, or zinc coolers, have lately been occasionally tried, but were found so injurious as to be very soon abandoned. Even iron coolers, although quite safe in some respects, will not be found so free from objection as the old wooden ones, when these are kept in good order. Perhaps slate coolers might be preferable to any if they could be kept quite tight. They could be easily cleaned, and liquids get much sooner cool, on account of the difference in the radiation of heat, when exposed in vessels having black than they do in those with white surfaces.

This was exemplified many years ago in Glasgow, during what was called the *teapot* war, which occurred during the residence of my friend the late Dr. Birkbeck there. Black porcelain teapots had then been lately introduced there, and were getting into use. The ladies, however, declared that their tea when made in these was by no means so good as formerly, and strongly objected to them on that account. The gentlemen ridiculed the idea, that it could make any difference in the tea whether it was made in a white or a black teapot. The ladies, however, stuck to their point, and the dispute ran so high that Dr. Birkbeck was appealed to on the subject; he, after due examination, gave it in favour of the ladies, on account of the water not retaining its heat in the black teapots so well as in the others, and, consequently, not causing the tea to draw (as it is called) in equal perfection.

Dr. Birkbeck told this story with great glee, calling it the war of the teapots in which he had been engaged.

SACCHAROMETER.

The late Mr. Richardson, of Hull, was the inventor of an instrument for ascertaining on scientific principles, the real value of malt. Before his time, many rude means had been resorted to for that purpose. Equal quantities, for instance, of wort and water were weighed against each other, but this method was found to be both troublesome and uncertain, and was only practised by very few. Since his time, various instruments have been introduced for the same purpose; but for real utility in practice, it has not as yet been excelled by any; and having only one pound gravity on the stem, fewer mistakes can occur than when there are 10 or 20 lbs. in the same space. These instruments are still manufactured and sold by Mr. Joseph Long, Hydrometer-maker, &c., 20, Little Tower Street, London. For his scientific knowledge, and accuracy in all matters of this kind, we can vouch.

The Saccharometer sanctioned by government, is that constructed by Mr. Bates, which shows the specific gravity of the worts, as compared with water at unity, or 1000 ; thus progressing to 1020, 40, 60, 80, to 1140, which is quite enough for the specific gravity of worts, for beer of every description. Richardson's instrument shows the increase of weight of the worts according to the actual number of pounds of saccharine matter, held in solution by the said worts. For instance, if 50 lbs. specific gravity by Bates's or Allan's instruments were held in solution by the worts, thirty pounds of water would be displaced. Hence Bates's or Allan's instruments would show 50 lbs. per barrel, while Richardson's would show about 18·3 ; the difference being as 1 to 2·78.

Long has invented an instrument with only one weight; one side of the stem without any weight, indicating to the extent of 25 or 26 lbs. gravity; the other with the weight, going to the extent of 50 or 52 lbs. gravity. We would, however, recommend the instruments made by him on the late Mr. Richardson's principle, as being much less liable to error than those having so many pounds indicated on one stem. The indications, however, of any Saccharometer, if accurate, may be easily compared and reduced to the scale of others by recollecting that the saccharometer indicating specific gravity per barrel, is founded on the fact that a barrel of water at 62° F. weighs 360 lbs., while the saccharometer of Allan or Bates, indicating specific gravity, has 1000 for its unit. Dividing 1000 by 360, we obtain the factor 2·78, near enough at least for practical purposes. The rule, therefore, in comparing the indications of instruments marking specific gravity to lbs. per barrel, is simply to divide the gravity shown by 2·78, and the lbs. gravity by Long's saccharometer; or to convert Long's gravity to the specific gravity of Allan or Bates, multiply by 2·78. Richardson's instrument, as made by Long and other accurate makers, is sufficiently delicate for all ordinary purposes; although some may prefer an instrument indicating *specific gravity*, as Allan's of Edinburgh, the invention of Professor Thomson of Glasgow College, and which is generally used by the Scotch ale brewers. The range of Allan's or Bates's, being 2·5 times at least, that of a saccharometer where minute attention in noting the progress of the *attenuation* is required, the *specific gravity scale* may be adopted. (See in Appendix some further remarks on an erroneous mode of taking gravities in Ireland.)

MASHING.

When the liquor for the first mash is turned on the malt at too high a temperature, instead of producing an extract, it occasions a coagulation, forming a sort of thin paste, like thin batter, or starch when preparing for stiffening linen. This we call setting the goods, and little or no worts will be discharged.

This evil, although it never can be thoroughly cured, may sometimes be partially rectified, by sprinkling over the mash a quantity of colder, or even of cold liquor, so as to reduce the temperature. Since thermometers have been so generally introduced, setting the goods has not occurred so frequently. It is, however, of the utmost importance to take the first liquors at the proper temperatures, and for that purpose the following process will be found infallible.

Further Remarks on Mashing.

Since our first writing on this subject, a different, and, we are inclined to think, a more certain mode has been adopted to secure the proper temperature for making the best extract in the first mash; after which, as before stated, particular temperatures may be considered of very little importance.

Best Temperatures.

We now find that at the temperature of about 168° to 170° Fahrenheit, the diastase of the malt acts most powerfully in saccharising the starch contained in the malted or unmalted corn. If, therefore, we do not go above that temperature, we run no risk of setting the goods, let the temperature of the malt in the tun be what it may. What we have, therefore, to do, is to make in the first place, as stiff a mash as possible, with liquor at that temperature, that is, of 168° or 170°; we are thus certain that some part of the diastase must be acting upon the starch, thus preparing the whole mash for the extract being speedily formed by the after process. With powerful machinery, about one barrel and a half of liquor per quarter will be found sufficient for this first part of the process. Where oars, however, must be used, we would recommend that the liquor should, in the first place, be put into the tun, and brought to its proper temperature, of about 170° or some degrees lower. The malt should then be added, sack by sack, as quickly as possible, but at the same time taking care that the previous sack of malt be thoroughly mixed and wetted by the oars and rakes before any addition is made. If the mash becomes too thick for working, a little liquor may be added at any time, so as to make the mash manageable.

Having thus prepared the malt in the tun in the best manner, for the extract being speedily performed, we must now turn on, from below the goods, liquor at a temperature of 185° to 195°, gradually increasing in temperature; letting it run, however, at first very slowly, so as to bring up the heat gradually, at the same time mashing during the whole process. In a very short time a complete change will be observed in the appearance of the mash. The extract, which before had a milky white appearance, will almost instantaneously become more transparent, and a fine thick frothy head will appear all over the tun. The extract is then thoroughly formed, and the quantity of liquor may be then proportioned to the quality of the intended beer: say for beer of very high gravities, not more in the whole than two barrels and a-half per quarter, but for beer of lower gravities, perhaps, even three barrels per quarter may be found most advantageous.

Having thus made sure of a proper extract, there can be no advantage in allowing the mash to stand very long before running off the worts. An hour and a-half at the utmost is quite enough. In imperfectly made malts, that is, malt not sufficiently *grown* on the floors, as shown by the spires not being well up the backs, it may be advisable to grind such *lower* or finer. It may be better also to commence mashing at a lower temperature of not less than 10°, say 160°, taking care, however, to bring up the heat before leaving off mashing, so as that the tap or worts may run off the tun at a heat of from 148° to 152° as usual.

No Time to be lost.

The great desideratum now is, to get through the remainder of the process as quickly as possible, so as to prevent the possibility of any unsoundness being acquired, by the worts lying too long anywhere before being got into the copper.

Having, we trust, sufficiently explained what we consider a correct mode of making the extract, we do not intend here to go on further with the process, as that can be easily learned by referring to any of the practical brewing tables at the end of this treatise.

As before stated, all we can further do is to wash out from the malt, in the best way we can, whatever extracts may be retained after running off the first tap. There are some who by turning over large quantities of water at very high temperatures, for the raw wort, think, and can, perhaps, show a little more gravity per quarter, as indicated by the saccharometer; but this additional gravity is not saccharine, but mucilage, or some other impurity, which they would be much better without.

It is now, we believe, universally admitted, that mashing or making the extract is a strictly chemical process; the more closely, then, we adhere to chemical rules, the better we are likely to succeed. Many, however, are of opinion, that if a trifling extra gravity per quarter can be obtained, no matter by what means, so much additional profit will be gained. This will be found to be fallacious, and not founded on fact. A foreign projector, many years ago, supposed that by a mixture of sulphuric acid in the worts, the extract would be greatly increased, on the same principle as that of the converting starch into sugar by a similar application; this, however, was found to be a total failure, as several parties discovered to their loss. We understand that other projectors are again attempting to introduce the same fallacy, but the absurdity of this practice in brewing has now become so well known as to render it unworthy of further notice.

Another party, having adopted an erroneous and unfounded opinion respecting the immense power of the action of the substance called *Diastase*, in making the extract in the mash-tun, has pretended that, by some new invention of his own, he can by these means make very extraordinary extracts, far superior in every respect to those which can be produced in any other way. (See separate article on "Diastase.")

Upon examination we can discover no benefit to be derived from this process, as it occupies a great deal of unnecessary time, and incurs a considerable expense in machinery, as can be easily proved. From the immense time occupied in the first mash, we can only suppose that some similar method to that mentioned in the preceding article must be requisite in making the extract; so that no advantage can possibly be gained by it, but the contrary, as it only in other respects creates delay.

Another equally useless process is that of drenching the malt with great additional quantities of water, at high temperatures, after it has been already exhausted, for the purpose of squeezing, if possible, a little more extract out of it, the parties thereby conceiving that they gain considerable advantages over their less scientific neighbours. Any additional extract gained, or rather supposed to be gained, by this process does more harm than good; it is only robbing the cows, and answers no other earthly purpose.

Beer, when brewed with such raw worts, although it may show a little additional fallacious gravity by the saccharometer, will taste much weaker, and sooner go to decay, than that of less apparent gravity, in which these extraordinary raw worts have not been used.

On the Use of Hot or Cold Water in the last Mashings.

There is perhaps no profession in which effects are more generally attributed to wrong causes, than in that of brewing : any deviation, therefore, from old usages would be considered dangerous, and should the brewing turn out in any way different from others, the deviation would be considered as the cause of it.

Many brewers are consequently averse to use cold water in their last mashings, having an idea that it tends to create acidity in the worts, as well as to cause other injurious effects. It has been before stated that the great desideratum in the process of making the extract (or mashing) is to avoid delay, particularly in warm weather. The shorter time, therefore, occupied in that process, the less risk we run of the worts getting tainted from their hanging about anywhere between the mash-tun and the copper.

Where there is only one copper, a considerable time is often occupied in getting up the water to what may be considered a sufficient heat for the last mashings, and, consequently, the first worts must be kept hanging about in the underback or elsewhere, until this be effected.

This hanging about of the worts is often the cause of acidity, which, although it may be corrected to a certain extent, can never afterwards be altogether remedied. From having often had only one copper to work with in the same premises, and seeing the great delay and also expense incurred in bringing up the head, I was induced to try the effect of using cold water instead of hot in the last mashings. Having, upon full investigation, ascertained, in the first place, that this caused no detriment in any way to the worts, I determined to try the same method more generally, and have now come to the conclusion that, when the first mash has been scientifically and thoroughly made, and a second mash of sufficiently hot water has been used, all that remains of the extract will be washed out better with cold water, say not above the temperature of the atmosphere in mild weather, than in any other manner whatever. I also find that there is no more risk of acidity, and I am inclined to think rather less, than when high temperatures are employed for that purpose. The moderately cold water will fully extract any beneficial saccharine matter that may remain in the malt, without producing the injurious effects before mentioned, by the drenching of the grains with over high temperatures. This last mash, or mashings, however, should be sparged or sprinkled over the malt like a shower of rain, and should be got into the copper with as little delay as possible.

TAPS.

Of the Produce of Taps, according to the Number of Barrels turned on the Malt.

Many erroneous accounts have been given as to the quantity of water, or more properly of wort, retained by the malt, after draining off the first mash: as this may be considered a point of some importance to young brewers, as a check or guide for ascertaining that no mistakes have been made in turning on the different quantities of liquor, we shall here insert our own observations on the subject. The results, however, will vary a little, according to the depth of the malt in the mash-tun, the greater depth producing more extract, and *vice versâ.*

When the first mash is drained off, fine malts will retain about 4 gallons per bushel, or 32 gallons per quarter; inferior malts will retain 4½ gallons per bushel, or 36 gallons per quarter, more or less, according to quality, affording a sure guide to ascertain the quantities of liquor which have been used in mashing.

Thus, if brewing 10 quarters of malt we mash with 20 barrels, we should find in the under-back or copper from 10 to 11 barrels, or perhaps, sometimes, a few gallons more of wort, according to the quantity of the malt, and its depth in the mash-tun; whatever additional quantity of liquor may be turned on during the first mash, we should find that additional quantity in the worts when collected.

In the after mashings we generally find that the malt will yield a little more than the quantity turned on, which may be easily accounted for by the decrease in the bulk of the malt after every subsequent mashing.

OF BOILING.

Various opinions exist as to the boiling of worts. Some think that long boiling, particularly of the second worts, tends to make the beer continue sound. We are not, however, aware of any preservative quality imparted by long boiling; but on the contrary, many injurious effects may be produced by over-boiling, some of which shall be afterwards considered. Long boiling, with free evaporation, undoubtedly adds to the strength of the worts, in proportion to the extent of the evaporation, and thus enables us to made a greater extract from the malt than we could otherwise do, particularly in brewing very strong beers. But where a raw or return wort is taken for next brewing, little or no advantage can be derived therefrom. Mr. Morewood says that at Louvain, in Belgium, which is rather celebrated for its beer, a portion of quick lime is thrown into the worts when boiling, — a very good thing — but soda would be preferable.—*Morewood's Inebriating Liquors*, p. 257.

An erroneous opinion often prevails, that a portion of the saccharine matter of the worts is evaporated along with the steam in boiling. This opinion may have arisen from a mistake in calculating the difference of the extract as shown by the taps, between these taps, and the actual gravity of the boiled worts in the gyle-tun—or the difference, as some call it, between the raw and boiled gravities. An erroneous method of calculating the extract per quarter is followed by some brewers, who value the gravity of the worts as they flow from the mash-tun, instead of taking the gravity of the worts from the coolers as they go into the fermenting tun; thus showing a disparity of from 10 to even 20 per cent. more than the malt actually produces. We shall, however, be able to show, when we afterwards treat of extracts, that both gravities, if properly taken, must be precisely the same, only deducting for the quantity retained by the hops in the different boilings, which is afterwards transferred from one wort to the other in regular progression, so as ultimately to leave in the hops only a very trifling portion of the extract.

There is also a difference of opinion as to the use of open and dome coppers. For fine pale ale, there can be very little doubt that open coppers are preferable, although dome-coppers, (where a free evaporation of steam is allowed without *much* pressure) can do little harm. It is to be recollected, however, that in proportion to the perpendicular column of worts in the copper, and also to their greater specific gravity, charring will take place.

Where, however, a considerable weight must be raised before any steam can escape, as in steam-engine boilers, considerable injury may arise, not only in the boiling of ale worts, but also of porter or stout worts; arising from the following causes.

In the first place, owing to the high pressure of steam, which must necessarily take place before the weight can be raised to allow of its escape, the evaporation of the worts in boiling is so trifling as to prevent the necessary increase of gravity, so as to enable the brewer to turn the proper quantity of liquor over his malt in the mash-tun, for producing the best extracts, particularly for beers of high gravities.

2. The weight to be raised before any escape of steam can take place, and the consequent high pressure, must necessarily raise the temperature of the worts in the copper far above the boiling point. This must, therefore, to a certain extent, alter the component parts of the worts, by charring or carbonising them. That this effect is produced, is sufficiently proved, not only by the brick-red colour of the worts when coming out of the copper, (although brewed from the palest malt,) but also by the beer, which can never have that fine pale or amber colour, so highly desirable for all sorts of ale.

3. The above-mentioned high temperature must also be to a certain extent injurious to brown beer,

as it extracts from the hops an astringent bitter, by no means palatable, and to many highly disagreeable. This may not in stout or porter be very perceptible, but in fine ales it is particularly obvious.

Of Charring the Worts.

It has also been observed, that when the worts are thus charred, the fermentations are very much inclined to get fretful at certain stages, thus endangering the quality of the beer. We have ourselves lately seen this effect produced, but immediately afterwards remedied by withdrawing the pressure. We are not at present prepared to say what may be the chemical causes of the above-mentioned fretful fermentations: perhaps the charring of the worts may so alter the nature of their component parts as to produce this effect.

But fermentations, generally speaking, are so apt to be influenced, by what, to many, would appear such trifling or even improbable causes, that they who have had an opportunity of seeing and tracing all their different anomalies, in their various stages, can alone find out and apply the necessary remedies.

Long or Short Boiling.

It must now be apparent that we are not advocates for long boiling, excepting as above stated, for the purpose of giving strength to the wort by evaporation. Long boiling can only be necessary when no raw wort is taken, to enable us to turn a greater quantity of liquor over the malt for the purpose of extract. As, however, a considerable portion of this additional liquor must be evaporated from the copper for the purpose of acquiring strength, perhaps the additional expense of coals and wear and tear may counterbalance any profit, which we may think we have derived from the little additional extract, we have thus gained from the malt.

We have had occasion to brew a good deal of beer for the Indian market, and we never on any occasion boiled the first worts more than one hour, or the second worts more than an hour and a half. In the Appendix will be found the reports received from Calcutta respecting some of it, which will show that notwithstanding the shortness of the boilings, the beer turned out well.

On the tendency of Worts to get tainted in the Coolers; its Causes and Preventives.

Worts are much more liable to get tainted in the coolers, when the weather is thick and hazy, than when it is clear and windy. The cause of this, however, so far as we know, has not as yet been scientifically accounted for. There can be no doubt, however, that it proceeds from the steam, which, instead of rising and being dissipated as in windy weather, becomes condensed in hazy weather, and by then falling on the worts in a liquid state, it produces acidity, or *foxyness*, as it is technically called.

It has been already stated, that condensed steam is injurious, in every stage of the process of brewing, and particularly so in the cooling of the worts. Steam, as has been lately discovered under certain circumstances, is perhaps the most powerful positive electric yet known, and therefore by falling on the worts on the coolers in a condensed state, may produce acidity.

Our opinion is, that little good can be effected by cooling the worts much below the temperature of the atmosphere at the time, (in winter we must, of course, watch to prevent their getting too low,) unless, as in Bavaria, the tun-rooms can also be kept at an equally low temperature. The reason of this is obvious; if the temperature of the tun-room be the same as the atmosphere, the worts will also rise to that temperature, without gaining a regular progressive attenuation, unless checked by regulators, which we would rather dispense with at all times if possible.—*See article on Regulators.*

Now, as it is the steam hanging on the worts which prevents their cooling, if that can be blown away or dissipated, they will soon arrive at a sufficiently low temperature, perhaps a degree or two below that of the atmosphere. Fans or blowers will do this effectually, and also keep the worts in a state of constant motion, which is also a great preservative; and if a portion of the hop dreg has been allowed to pass over along with them into the coolers, there will then be but little danger of their becoming tainted in cooling at any time. — *See article on Hop Dreg.*

It was believed by many brewers, that worts ought never to be stirred on the coolers at all; but as this old and erroneous opinion appears now to be pretty nearly abandoned, it is needless to say any thing more on the subject.

We are told that some brewers have now acquired such faith in refrigerators, as to think that they may dispense with coolers almost entirely. We strongly fear, however, that before the end of the first summer, they will have reason to repent of this over confidence, and lose more by the deterioration of their beer than the first cost of new coolers. — *See article on Refrigerators.*

A great deal of attention has lately been bestowed in the brewery, upon various mechanical arrangements, for the purpose of saving labour, &c.; but many of these changes seem to have been adopted, without any regard to their probable consequences.

Were our brewers, however, as has been already observed, to devote a little more attention to chemistry, they would soon discover, that, notwithstanding these so-called improvements may facilitate labour, and be otherwise desirable in some respects, they do not in any way tend to improve the quality of the beer. It is now stated, that when beer shipped for India is placed upon or near sulphur it causes it to get acid, and that the same effect is produced when the casks are stowed upon iron. May not, however, the electro-chemical action, during the fermentation be, in some measure, the cause of this change in the character of the beer; at all events, beer brewed in this manner has seldom or ever been found to stand the climate, or to bear a remunerating price in that market.

In former times, there was always a cessation from brewing during the heat of summer, in consequence of the uncertainty of the process, arising from various causes. Now, however, little or no alteration is made on that account, and various mechanical means have been adopted to counteract the heat of the weather during that season. First fanners, or fans on the coolers were tried, which were found to answer very well, as they cooled the worts sufficiently without otherwise injuring the beer, as will be afterwards explained.

Fanners gave place to refrigerators, which were first constructed in such a manner as to allow the worts to run through different pipes employed for the purpose, while currents of cold water were continually passing over their outer surfaces; these, however, for various reasons unnecessary to mention in this place, were not found to answer, and were consequently soon relinquished.

The currents of cold water were then run through the *interior* of the pipes, and the worts brought into contact with their exterior surfaces.

These refrigerators are now constructed in various modes, and are still very commonly employed, and the pipes are formed of mixtures of metals of different kinds.

In addition to these, regulators are used in the fermenting tuns, for the purpose of cooling down the worts, or preventing their attaining too high temperatures during the fermentation. Both of these contrivances have been found to produce the desired effect, in as far as regards the regulation of temperature; but it is now beginning to be discovered, as might have been expected, that they have an injurious effect upon the worts, by causing acidity to a certain extent and consequent decay, and often foulness in the beer; the causes of which have been fully explained in the former part of this work, as also the bad tendency of other apparatus of the same description.

We have already adverted to fanners, or blowers, as being the safest and best mode of cooling down the worts in the coolers, and these will at all seasons be found fully adequate to that purpose.

It is but in very few seasons in this country, and even then but for a very short period, that the temperature of the atmosphere in summer will not be at least as low as 65° during the night. Let brewers, then, commence their operations at such a time of day as to allow them to get their worts out of the coppers in the cool of the evening; and if they have but one boiling at this season, so much the better. Good fanners will then soon cool down the worts to the lowest temperature of the air during the night, if so required, and at the same time will keep them in motion in the coolers, which is also beneficial in keeping them sound. No benefit can result from cooling the worts below the lowest temperature of the atmosphere at this season, as the heat of the next day will again raise them, without the fermentation and attenuation going on progressively, unless the tun rooms are cooler than the air, or regulators are employed, which last, unless differently constructed from what they now are, do more harm than good. The fermentations, if properly carried on, and in suitable tun rooms, may by these means be conducted so as never to exceed 80° during their progress, and may often be considerably lower, that is, under ordinary circumstances, it being understood that ale of very great gravity should never be brewed at this season if it can be avoided.

What, then, is the use of all these unnecessary and expensive appendages of refrigerators, regulators, &c., which do injury to the beer, by their electro-chemical action, instead of benefiting it? Other more simple and less injurious means may be easily adopted when requisite for attaining the same purposes. These may also prevent the necessity, which appears now to exist, of making the porter so exceedingly black in the colour as it now is; and, possibly, when the colour of the beer can be again ascertained in the pewter pots, should there happen to be anything amiss in the beer, the whole odium may not, as it now is (sometimes very unjustly), be thrown upon the publicans alone, but the brewers also be allowed to come in for their share of the blame.

CALCULATING LENGTHS AND GRAVITIES.

From the erroneous mode generally practised of calculating the gravities of the taps or raw worts, as they are generally termed, a very great discrepancy appears betwixt what is called the raw and boiled gravity, or, in other words, the gravities shown by the taps, and the actual or real gravities in the gyle-tun.

It is now an ascertained fact, that little or no saccharine matter evaporates with the steam in boiling, and consequently the gravities of the taps, if properly taken, ought exactly to coincide with the gravities in the gyle-tun, making allowance only for what may be retained by the hops in the last wort.

We all know that the gravities of the taps, or worts running from the mash-tun, vary considerably, according to the times at which the samples may be taken; thus leading to erroneous conclusions. The only accurate mode, therefore, of calculating the gravities of the unboiled worts, must be by taking samples from the under-back after being thoroughly roused, or better, from the copper when the worts are therein collected, and after about ten minutes' boiling.

The common practice is even then to calculate the gravity as when reduced to a temperature of 60°, without making any deduction for the decrease in quantity necessary to reduce the worts to that temperature, by evaporation and condensation. We thus calculate a gravity (taking in what is retained by the hops) of at least ten per cent. more than we actually have: making all the difference between the (so denominated) raw and boiled gravities.

The Excise, when taking the dip of hot worts in the coolers, always allowed ten per cent. for evaporation and condensation. The same allowance should be made when taking hot worts in the copper—when we shall find that the raw and boiled gravities will very nearly correspond.

In making calculations for regulating the gravities per barrel of the different beers to be brewed, it will generally be found that by deducting ten per cent. from the apparent gravity of the taps, as shown by the instrument at a temperature of 60°, we shall come very near the truth, at least near enough for practice. Should extra quantities of hops be used, allowance must be made accordingly. This, however, is only for the first worts. Every 60 lbs. weight of hops retains nearly a barrel of worts of the same gravity as those turned out of the copper. For the second worts, therefore, after deducting the ten per cent., add the gravity of one barrel of the first worts for every 60 lbs. of hops used in the first boiling. This in the second boiling will be replaced by nearly an equal quantity of worts, of the same gravity as turned out of the copper, which, in making the calculation, is to be deducted from the aggregate of the second worts, and so on with a third wort if necessary.

Having thus made accurate calculations of the actual number of pounds gravity we have in the gyle-tun, the aggregate amount of pounds gravity is to be divided by the number of pounds gravity per barrel the beer is intended to be made; the quotient is the number of barrels at said gravity, which can be produced. All we have now to do is to turn out of the copper such a number of barrels as will make up our calculated quantity in the gyle-tun. The only difference that can then arise must proceed from the difference of evaporation from the wort in the coolers, which will be found to vary more or less according to the state of the atmosphere. Our beer, therefore, must be a little stronger or weaker accordingly; but the aggregate gravity will be found to correspond very nearly with the calculation made from the unboiled worts; and the brewer, by a little attention, will soon be enabled to judge of the quantities to be turned out of the copper, so as to correspond with the evaporation which he may expect.

RAW OR RETURN WORTS.

Raw or return worts are now universally used in all great brewing establishments. It is, however, a very questionable point, whether the apparent extra gravity derived from the said raw worts, is of much value, or even worth taking. In brewing ale or any description of beer of very high specific gravity, raw worts cannot well be dispensed with, as we should not get the proper extract from the malt, so as to throw it into the beer, without turning over in the mash-tun a much greater quantity of liquor than is wanted for the production of beers of that gravity; but wherever we have an opportunity of turning over the malt about six barrels per quarter, there can be little doubt but that the whole gravity worth having can be obtained without having recourse to a raw wort in the mash-tun. The sparging machine bringing off the worts at not above one lb. gravity, renders a return wort a matter of very inferior consequence: as, however, some valuable extract may remain in the hops, a sufficient quantity of liquor may be turned over them to displace it. We have known brewers so anxious to make apparently very high gravities from their malt, as even to turn over to the extent of three and four barrels per quarter, after having already turned over at least six barrels per quarter.

It may be observed, however, that the beer brewed from these long raw worts, not only uniformly tasted poor, but was very much inclined to get forward or acid. We therefore strongly recommend to brewers to be satisfied with the extracts usually obtained, rather than to run the risk of acidity, by getting mucilage or other extraneous matter from the malt: which, however much it may buoy up the instrument, adds nothing to the quality of the beer.

Two barrels per quarter of raw wort are decidedly as much as ever ought to be attempted, and more will do harm rather than good.

It is a disputed point whether hot or cold liquor should be applied in taking the raw worts. The point is of very little importance; but the temperature of the liquor should never exceed 160° or 170°.

An opinion prevails that the raw wort should never be turned over in the first mash next day, but be reserved for the subsequent mashes. The sooner the raw wort can be used the less risk we run of unsoundness; and any one, upon reflection, will see that turning all the raw wort over in the first mash is the surest mode of getting the soundest and best extract. When turned all over in the first mash, much about the additional gravity, contained in the raw wort, will be shown in the tap; and what remains in the grains will be much better washed out by hot liquor alone, than when it is mixed with raw wort.

REFRIGERATORS.

The use of refrigerators for cooling the worts has now become very prevalent. It is, however, rather a doubtful point, whether an indiscriminate use of them does not do more harm than good. In the refrigerators first constructed the worts were passed through the pipes, and the cold water was applied to the outside. These, from the difficulty of cleaning and other causes, were found to be injurious, and are now succeeded by others in which the cold water runs through the pipes, and the worts are on the outside.

The more simply refrigerators can be constructed the better: they ought also to be made of one metal only, and that unconnected with other metals. We thus run less risk of any electro-chemical agency, which should always be guarded against, as much as possible, in every department of the brewery. Even with the best constructed refrigerators, it will be found that when the worts are sent through them at high temperatures, they will appear of a greyish or whey colour when running into the square. This always denotes unsoundness to a certain extent, or that some change has taken place in the nature of the worts, which will be found prejudicial in as far as regards a regular fermentation. However desirable, therefore, refrigerators may be for saving time, we are inclined to think that fans or blowers are by much the safer instruments for cooling worts.

Worts when kept in a constant state of agitation in the coolers, are much less liable to become tainted than when allowed to remain stationary: fans or blowers keep them constantly in agitation, and when a proper quantity of hop-dreg is passed over into the coolers along with the worts, little danger need be apprehended.

Many brewers make it an invariable rule, both in summer and winter, to commence brewing at a very early hour in the morning. A little reflection, however, will convince them that in hot weather, it is much better to commence at a much later period of the day; by so doing they will have the advantage of night for cooling their worts, and with the assistance of fans or blowers, they can at all events, with few exceptions, get their worts to a temperature of 60° before letting them run into the gyle-tun. This temperature, in hot weather, is as low as it would be desirable to go, unless the tun rooms can at all times be kept considerably under the temperature of the atmosphere.

Fans or blowers, therefore, may be considered, for the reasons above stated, preferable to the best refrigerators.

REGULATORS FOR THE TUNS.

It is, no doubt, a very desirable object to have the means of regulating and keeping in check the temperatures of the worts during fermentation; but if for that purpose we employ chains of pipes fixed in the gyle-tuns, consisting of different metals joined with each other, it is liable to the same objections with regard to galvanic action as when such pipes are otherwise connected with the tuns, and will generally be found to be attended with effects nearly as injurious.

Moveable regulators are the best; they can be applied or removed at pleasure. In winter or cold weather, regulators are very seldom necessary, and may then be altogether withdrawn from the gyle-tuns, thus removing the possibility of any voltaic action from a mixture of metals. The regulators which we recommend are very simple, and may be made at a very trifling expense.

Pipes consisting of one metal only, and of three or four inches diameter, should be formed into a rectangular or circular vessel. This vessel must of course be water tight, and strong enough to resist any pressure which may occur. In one of the sides of this vessel two openings about one inch and a half or two inches in diameter, must be made about ten inches apart, and these fitted with screw-joints, to which flexible water-tight pipes may be attached, the one for admitting the cold water, the other for its discharge anywhere over the top of the square. This vessel, which in size must be proportioned to the gyle-tun, may be suspended from any beam above the gyle-tun, by means of a rope and pulley, so as to be let down into the worts, or withdrawn at pleasure. These will be found to answer the purpose intended as well as the most expensive instruments now in use, or perhaps even better. These regulators should only be allowed to descend a few inches into the body of the worts. We all know that liquids, generally speaking, as they cool, become specifically heavier, and thus the portions first cooled on the surface will sink down, while those which are warmer, and of course specifically lighter, will rise up to supply their place.

If worts be cooled down too rapidly in the fermenting back, the fermentation will be checked, and it is sometimes found difficult to restore its vigour. By the above method, the process of checking the temperature is carried on much more gradually and equally, and without any risk of checking the fermentation. The worts, also, are at the same time all kept in motion, from the rising of the warmer and sinking of the cooler parts, which is also advantageous and perhaps better than rousing. Regulators, when placed near the bottom of fermenting tuns, do very little more, for a long time, than cool the worts at their own level, and even then not equally, unless the whole be kept in a constant state of agitation by means of rousing. Regulators, however, should never be used, so as to cool down the worts during fermentation, but should be so adjusted as to permit a gradual increase of temperature.

OF YEAST.

To keep yeast in proper working trim, is a matter of as great importance as any connected with the brewery. That this can be always done, there is not the slightest doubt; and those who assert the contrary, only betray their ignorance. We could name brewers who have had no change of yeast for years, (unless when making a long stop,) and their fermentations, have uniformly gone on successfully.

Where fretful and unsound fermentations are going on, the yeast will no doubt also become fretful and unsound. But where the fermentations are sound and healthy, the yeast will be the same, if the proper precautions be taken to keep it so. (See Fermentation — On the Causes of Unsoundness.) How often do we find changes of yeast producing more harm than good, when procured from unhealthy or unsound stocks. If, then, the proper precautions be taken to avoid unsoundness in the worts, there is little doubt but the yeast will go on, doing its work regularly, and no change will be found necessary, unless from a long stoppage of the work.

As yeast, however, is apt to get stale when too long kept, frequent brewings are necessary to prevent its doing so. In summer particularly, the yeast cannot be kept in proper working trim, with fewer than two brewings a week; if more often, the better.

Best Mode of Preserving Yeast.

Yeast, when taken out of the stillions and thrown into tubs or reservoirs, begins to work and fret, thereby expending its strength, and thus becomes unfit for carrying on a healthy and vigorous fermentation in the fluid to which it may be added. Pitching yeast should, therefore, be allowed to remain in the stillions, with a portion of the drawings, until wanted for use: the drawings should then be removed, and the yeast taken up. In the country, where sometimes it is difficult to procure a fresh store of yeast, when required, the best mode of preservation is to place the yeast, when taken up, in the coolest part of the premises, and pour over it the coldest water which can be procured. The water should occasionally be poured off and renewed. If ice can be obtained it is better than water. We generally find that yeast about the second or third day after cleansing is in its best working trim.

Quantities to be used.

It is a very generally received opinion that the stronger the worts, the less yeast is necessary. We cannot, however, subscribe to this opinion, but on the contrary must contend, that if an artificial ferment be at all necessary, the quantity should be proportional to the work it has to do; or, in other words, in proportion to the saccharine matter to be attenuated. A smaller quantity might perhaps ultimately have the desired effect, as we see in very long fermentations; but this is leaving in some degree to chance, what may be effected with certainty, in a much shorter time, by a different, and certainly a better process. All sorts of beer, both ale and porter, may be produced equally as good, or perhaps better, by comparatively shorter fermentations, as by the longest now in use: and they will always be found to retain their vinosity and soundness much longer than the others.

The quantities of yeast to be used, however, must necessarily vary according to circumstances. When the worts are got together in the gyle-tun at high temperatures, such as 65° to 70°, less yeast will be necessary than when got together at temperatures which are lower, say from 53° to 60°. If the proper quantity of yeast be applied to sound worts, we generally find that for every degree of temperature gained, the worts will attenuate one pound in gravity by Long's instrument, or 2·78 by Allan's and Bates' instruments; the quantities of yeast to be applied should therefore be so regulated as to preserve this uniformity, which is a sure guide to work by. This rule will not apply, however, where long fermentations are practised.

Many brewers conceive, that by long fermentations, their beer retains more fulness on the palate than with a shorter process. We entirely differ from them, however, on that subject, and maintain that when worts are kept in the gyle-tuns ten to fourteen days or more, the fermentations are much more liable to suffer injury from the atmospherical or other fluctuations which may take place during that period, than can possibly be the case in a process of from forty to seventy hours, or even sometimes shorter.

It will always be found also, that beers having undergone a healthy and not too vigorous fermentation, will acquire fulness from age; while on the contrary, those undergoing a long fermentation lose their fulness, and very often become sour.

Many brewers are in the practice of using yeast by measure. This is a very uncertain mode of procedure, as yeast will vary in weight many pounds per gallon. The surest and best mode of applying yeast is by weight, and when we are not thoroughly acquainted with its quality, it should always be mixed with a small portion of worts at a temperature of from 80° to 90°; and should be seen rising in whatever vessel it may have been mixed, before it is added to the worts in the fermenting tun.

When worts are got together in the gyle-tun at a temperature under 60° F., about 1 lb. of yeast to 10 lbs. gravity per Long's instrument, will be found to produce a loss of 1 lb. in attenuation, for every degree gained in heat. This is a good working rule. When the fermentation (from unsoundness in the worts or other causes) does not go on regularly, the beer is apt to get yeast-bitten; and the quantity of yeast used, is blamed as the cause. This evil, however, more frequently arises from too little yeast than from too much. It is impossible to describe by writing, the different anomalous appearances which take place in fermentation, and therefore equally impossible to say what should be done under certain circumstances, unless by personal inspection and examination; when the causes of the different anomalies which take place must be traced, and where unfavourable, rectified, before any permanent improvement can be expected.

Fermentation an Act of Vegetation.

M. Turpin has lately published his observations upon certain phenomena, which he considers sufficient to show, that the act of fermentation concerning which chemists have been so much embarrassed, is owing to the rapid development of infusorial plants. He states that all yeast, of whatever description, derives its origin from the separation from organic tissue, whether animal or vegetable, of special particles of extreme minuteness, which particles, after a certain time, rise to the surface of the fluids in which they are immersed, and there germinate. Their germination is caused by a certain amount of heat, and by contact with atmospheric air. The carbonic acid obtained by fermentation is ascribed to the infusorial plants. M. Turpin considers the act of adding yeast to liquids, when fermentation is languid, equivalent to sowing millions of seeds in a favourable soil. He calls the yeast plant of beer *Torula cerevisiæ;* he considers each infusion to have its peculiar plant, and he names the whole race of such beings *Levurians.* No doubt the yeast of beer consists of minute molecular matter, the particles of which are globular, and that those particles produce from their sides, other particles like themselves, which eventually separate from the parent, but we do not know that they are *therefore* plants.

Before the experiments of Mr. Brand, alcohol was by many supposed to be a product of distillation, and not of fermentation. He has, however, satisfactorily proved its existence in the fermented wash, by producing it already formed from that fluid without distillation.

Animalculæ in Yeast.

Other chemists have ventured to declare, that they have discovered living animalculæ in yeast. I here insert Professor Liebeg's opinion upon these subjects.

"The fermentation of sugar," says Professor Liebeg, "in contact with yeast, is quite distinct from that of a vegetable juice, or of wort of malt; in the first case, the yeast disappears with the sugar, whilst in the second instance, *it is formed* during the metamorphosis which the sugar undergoes.

"The form and the nature of these insoluble precipitates has suggested to several physiologists very singular views with regard to the nature of vegetation. When yeast of beer, or of wine diluted with water, is examined under the microscope, flattened and diaphanous globules are detected, which are frequently united in groups, and present an appearance of vegetation; others possess the aspect of certain infusoria.

"It would certainly be a very extraordinary phenomenon, if gluten and albumen, which have never been observed in the crystalline state, could assume a geometrical form in the process of the fermentation of wort of malt and vegetable juices. But this does not take place; these substances, on the contrary, separate in the same manner as all those which do not present a crystalline texture in the form of globules, swimming separately, or attached to each other.

"The appearance which they assume, in this instance, has induced certain philosophers to believe that they saw in yeast living organized beings, plants or animalcules, which, for food, assimilate the elements of sugar, and restore it as excretions, in the form of carbonic acid or alcohol. In this manner they explain the decomposition of sugar, and the augmentation of the mass of yeast in the fermentation of malt liquor.

"But this hypothesis destroys itself. In a pure aqueous solution of sugar, the so-called seed disappeared with the plants during fermentation; fermentation takes place, the sugar is decomposed at the same time as the yeast, but no appearance of the production and reproduction of the seed of plants and animals, which these philosophers recognise as the agents of the phenomenon, is exhibited." — (Annales de Chimie, lxxi. 187.)

Whether frequent Changes of Yeast are necessary or not in the Brewery.

When brewers get out of trim (technically so called), or in plainer language, into irregular fermentations, they immediately resort to changes of yeast as the only remedy to put themselves again to rights; such changes, however, are often more detrimental than useful. These irregularities, nine times out of ten, proceed either from tainted worts or atmospherical fluctuations, instead of any failure in the yeast. They cannot, therefore, be immediately remedied, unless by a better process of brewing, or a favourable change of electrical condition.

It often happens that the fermentation takes a favourable turn of this nature before a change of yeast can be had. Notwithstanding this, as effects are often attributed to wrong causes, particularly in the brewery, should the new yeast be used and any improvement follow, it is unhesitatingly ascribed by the brewer to the change, although his own yeast from a former brewing, under similar circumstances, might have acted equally well, or even better. It can even be easily proved that almost any yeast, under proper management, and all other circumstances at the same time favourable, may be brought into the best working trim in the course of two brewings; what use then for changes, unless from a total want of yeast by long cessations from brewing.

In combating this argument, we have been met by the assertion that changes of yeast in brewing are equally necessary as changes of seed for land; the latter, however, is a process of nature, while the former is an artificial or chemical process, wherein chemistry can supply all possible deficiencies. In corroboration of what has been said, we subjoin one or two letters from respectable brewers, who have been for years following this system of brewing without any occasion to have recourse to changes of yeast, and whose beer will at all times bear a comparison with that of any of their neighbours. Without reference, therefore, to the opinions of other writers on the subject, we have only further to say, that nothing is here stated but what we have convincing proof of, and are prepared to substantiate by experiment.

Dartmouth, 18*th January*, 1844.

Dear Sir, — In answer to your query respecting changes of yeast, I have only to say, that so far as I have seen, since pursuing your system of brewing, no change has been wanted, — it is certainly quite unnecessary.

I can easily understand that after any long cessation from brewing, a supply of fresh yeast must be required, — but in no other case, if your mode of working be strictly adhered to.

I am, yours truly,
John Baker.

Wm. Black, Esq.

Chesham, 15*th January*, 1844.

Dear Sir, — In reply to yours of the 10th, we are still of the same opinion, that, by your mode of working, a change of yeast is unnecessary, and as a proof of it, we used the same store you first brought with you for more than three years, and the tuns were uniformly healthy and vigorous; but during the last summer, as we were cleansing the brewery, &c., and consequently omitted a brewing or two, we obtained a fresh store, which we are still using with success. Perhaps you will be good enough to forward a copy of your new edition, when ready, and we will remit the amount.

We are, my dear Sir,
Yours, very truly,
Thos. and Jas. Nash.

Wm. Black, Esq.

Marine Brewery, *Ratcliffe*, *9th Jan.* 1844.

Dear Sir,—In reply to yours of the 4th instant, we beg to say that we are most decidedly of opinion that changes of yeast are quite unnecessary; in fact, we never have them except we are obliged, which only happens after we have been stopping for repairs.

We feel indebted to you for the compliment you pay to our beers, which we trust will continue to deserve the approbation of a brewer so well calculated to express an opinion.

Wishing you every success in the publication of the Third Edition of your valuable work, of which be pleased to send us a copy when published,

We are, dear Sir, yours very truly,
J. and W. S. Holt.

Wm. Black, Esq.,
4, Lansdowne Cottages, Islington.

FERMENTATION.

The process of fermentation has generally been considered by brewers as very mysterious and uncertain, and over which they have no control. This to a certain extent is no doubt true, for the yeasty heads covering the beer in the gyle-tun during fermentation will assume different appearances according to the fluctuations of the weather, and the seasons of the year. In summer we never see the light yeasty heads in the third change, rising to the fine rocky or alpine appearance which they assume in open frosty weather, nor do the yeasty heads in the fifth change become so close or solid. Windy or hazy weather also affects differently the appearance of the heads of the beer during fermentation. —(See *Regular Fermentation.*) Over these different appearances, therefore, we have no control, and very likely never shall, unless we could also command the weather. But although we cannot at all times attain the same fine appearances during fermentation, by proper management we can always obtain a sound, regular, and healthy fermentation, and which will invariably produce good beer. We shall now proceed to show how this may be accomplished.

All irregular or unhealthy fermentations arise either by the worts becoming tainted from bad management during some part of the process in brewing, or from positive electro-chemical action, which invariably produces acidity. I should here mention that negative electricity, although it prevents acidity, retards fermentation. In the first place, then, in order to have sound and untainted worts, the greatest cleanliness must be preserved in every stage of the process. First, the mash-tun and under-back should be thoroughly cleaned out, as soon as possible after brewing, the coolers the same. The wort pumps also should be strictly attended to, so that no portion of the worts of a former brewing can possibly be left in them. Very injurious effects are often produced from want of attention to this. Any unnecessary delay in the process of brewing may cause taint or faintness, from the taps being too long in being pumped into the copper. Under the article boiling, charring or carbonizing the worts by high pressure boiling in the copper, is mentioned as another cause of fretful fermentation.—(See cooling the Worts as another cause.) In short, such apparently trifling circumstances often produce such unsoundness, as to prevent the possibility of enumerating them.* (For electro-chemical action see *Electricity* and *Want of Uniformity in Beer.*)

We are now prepared, however, to assert and prove, that when worts are perfectly sound in all the stages of the process, their fermentation will at all times go on regularly and uniformly, if properly managed, and with sound yeast. The only difficulty, therefore, is, to know when any such unsoundness has actually taken place. A slight knowledge of chemistry will then not only materially assist us in tracing the evil to its cause, but also enable us, in after brewings, to prevent its occurrence, should it even proceed from atmospheric influence. As this evil, however, will sometimes arise, notwithstanding every precaution employed to prevent it, chemistry must be resorted to for enabling us to counteract its baneful effects.

---

* It may be proper to state that when acidification commences, fermentation, or perhaps more properly speaking, all further attenuation nearly ceases.

Litmus Paper.

If the brewer have a sensitive smell and *taste*, they will at all times enable him to judge of the soundness or unsoundness of his worts. But when these cannot be depended upon, litmus paper will be found a very useful substitute. All worts, even when running from the mash-tun, contain a portion of acid, which more or less, according to circumstances, will change the colour of the litmus paper. What we denominate sound worts, will give the paper a kind of dirty brownish red. When we find that the tinge of the paper is a brighter red, there must be additional acid, or perhaps a different acid, produced in some part of the process.

Having thus discovered that an excess of acid has been formed, chemistry must be resorted to for discovering the cause; and when found, we shall be enabled to apply the necessary preventives.

Best Temperature for Vinous Fermentation.

It has been generally found that what may be called a medium temperature during fermentation, has the best chance of producing beer of the proper vinosity and preservative quality. We have seen beer brewed in this country for which the fermentation was carried on at very high temperatures, say from 80° to upwards of 90°. We are also told from very high authority (Professor Liebeg) that the fermentations for Bavarian beer, so celebrated in Germany, are carried on at very low temperatures, say from 42° to 50° F., which could only be done in this country at a very great expense. The first of these, although it answered very well for immediate use, particularly in summer, soon acquired a mawkishness in flavour, and had always a want of vinosity, which, to those unaccustomed to drink it, would not be agreeable. The Bavarian beer that we have seen is precisely similar in these respects. It very much resembles in taste the beer brewed in this country for the Indian market, but neither in vinosity nor flavour would it bear any comparison with the best British beer of a similar description. Having thus given some account of the two extremes, we are still disposed to think that medium temperatures during fermentation, will be found to produce the best beer in every respect. Let us therefore take a range of from 52° to 78° F., thus allowing 26° to be gained during the fermentation, which is enough for the attenuation of any sort of beer when brewed in proper season. We must now keep in mind, that if the proper quantities of good yeast have been employed, (see *Yeast*,) for every rise of one degree in temperature, there should be a corresponding loss of gravity in the worts of 1 lb. per Long, or 2·78 by Allan's or Bates' instrument. For example, — if worts of 42 lbs. gravity per Long be got together in the gyle-tun at 52°, when the temperature rises to 78° they should have lost 26 lbs. of gravity, and thus be attenuated to 14 lbs., when tried by the instrument. We now proceed to describe the appearances exhibited during fermentations of different kinds, and first —

The Regular Fermentation.

We shall now proceed to describe what we consider a sound and regularly good fermentation. In such fermentation, five distinct changes occur, followed, after a certain stage, by a highly pungent aroma, which rises with the carbonic acid gas. If this aroma throughout the process be sound and vinous to the smell, we may feel assured that the worts are sound, and will go on regularly: if, on the contrary, a faintish, disagreeable, sub-acid flavour, arise at any time during the process, we know that acidity or unsoundness has taken place, which should be corrected.

1. The first stage of fermentation commences with a fine white substance like cream, appearing all round the edges of the gyle-tun; this creamy appearance gradually extends over the surface of the fluid in the tun. This we call creamed over, or the first change.

2. The next should be a curly appearance, like the head of a fine cauliflower, which should also extend all over the tun. This, the second change, we denominate the curling or cauliflower head. This cauliflower head should be examined very narrowly, as from its strong and healthy appearance or otherwise, we may pretty nearly judge of the health of the gyle. As above stated, it should have the appearance of a fine cauliflower. If, however, it should assume the appearance of a well curled wig, (we have no better phrase,) having broad flaky curls, it denotes unsoundness. The aroma should now be very perceptible.

3. The curly head should then rise to a light yeasty or rocky head, little more than perhaps from two to three feet high, of a fine brownish white colour if sound. If unsound, it assumes in some parts an ugly bluish-white appearance, which

often extends over the tun. This almost invariably happens where there is any galvanic action from chains of pipes, or a mixture of metals; and cannot be cured or prevented, but by doing away with the cause: that is by insulating the tuns.

4. After a time, the light yeasty head should drop a little, perhaps 3 or 4 inches. This we call the 4th change. The aroma should now be very vinous and pungent.

5. The light yeasty head which had dropped, should now rise to what we call a close yeasty head, having the appearance of yeast all over, with many little air bubbles on the top, not, however, larger than a nut or a walnut; these constantly breaking, and others supplying their place. If the fermentation has been healthy throughout, the close yeasty head will continue rising, and puffing out gas from the air bells, until the beer is thought ready for cleansing. This will take place earlier or later, according to the quality of the beer and the public taste. Should all these changes, as before stated, take place regularly, and be accompanied through the process by a sound healthy aroma, (generally termed "*stomach*,") we may rest assured that all is right, and that the beer, if afterwards properly treated in storing, will turn out sound and good.

Sometimes, however, instead of these five changes, not more than three are perceptible, all of them fretful and unhealthy. (These appearances will be more fully treated of, when we describe Irregular Fermentations.) In that case we know that the worts must have been tainted somewhere; the cause of which must be traced and corrected before any successful results can be expected. In most of the brewhouses which we have visited, we have invariably found, that the want of uniformity in fermentation did not arise from the uncertainty, as it is called, of the process, but from one or more of the causes before mentioned. We think, therefore, we are warranted in stating, that fermentations, when conducted on strictly chemical principles, may be carried on with nearly as great uniformity as any other chemical process.

Of Irregular Fermentation.

After what has been said about sound regular fermentations, it may by some be thought unnecessary to describe those which are irregular. There are many brewers, however, as before asserted, who from causes already mentioned, have never had it in their power to see a thoroughly regular and good fermentation. Such are apt to think that all is right, although the contrary may be the case; we, therefore, think it better to describe some kinds which have come under our own observation, and shall commence with

Inert Fermentation.

This is perhaps the most dangerous, because it is the most deceitful. This fermentation, to inexperienced, and even to many experienced brewers, has every appearance of proceeding remarkably well, and they of course think that all is right. The beer, however, will always taste mawkish and heavy, and without vinosity, although the attenuation may have been carried to its proper extent. There can be no doubt of its proceeding from some of the causes of unsoundness already mentioned. It first makes its appearance in the second change, viz. the curling top, which, instead of assuming the fine cauliflower appearance, diverges into long flaky curls hanging downwards; as soon as the "*stomach*" or smell of the gas begins to rise, a mawkish want of pungency and vinosity is discoverable by those who are acquainted with the proper odour.

The light yeasty head, instead of rising with a rocky appearance, is smooth all over; it, however, often drops regularly, as in a healthy fermentation. The proper close, yeasty head never rises, instead of which, if it does again rise, we have the same frothy appearance as before, smooth all over, with no appearance of air-bells as in a healthy process. The "*stomach*" also retains the same mawkish want of pungency and vinosity.

We have been thus minute in describing the progress of the above fermentation, because it is the most insidious and dangerous, as also the most common and least known or understood. How often do we hear of mawkishness in the taste which cannot be accounted for. We may rest assured that in nine instances out of ten, it proceeds from the inert fermentation, and not from want of boiling, to which it is generally ascribed.

Before the remedy can be known, the cause must be traced; every experienced brewer will then know how to proceed.

The Boiling Fermentation.

This, to look at, is the most formidable of the irregular forms of the process, and proceeds also from unsoundness in the worts, or occasionally from bad yeast; for which also there is no certain remedy but tracing and removing the cause. It commences, like others, with a creamy top, but the curl rises very light and faint, and in patches over the tun. The light yeasty head has an ugly, bluish-white appearance in some parts of the tun, while in others it has a fretful blistery appearance, and only just covering the beer: this is accompanied with little or no attenuation. The *stomach*, although sometimes pungent, is neither healthy nor vinous. When the light yeasty head disappears, no other head rises, and the fermentation very soon assumes the appearance of a boiling cauldron.

In the early part of our practice we have had occasion to see a good many boiling fermentations which we could not then account for. Since that time, however, we have been enabled to trace the causes, and invariably to remove them.

Of Close Fermentation.

Many think that fermentation goes on better when the gyle-tuns are accurately closed, so as to prevent contact with the atmosphere. In as far as regards the atmosphere, this opinion is correct; but when fermentation goes on vigorously, there can be no connection with the atmosphere, — the great production of carbonic acid gas excluding it. Carbonic acid gas is heavier than atmospheric air, in the proportion of 1527 to 1000, and while it floats on the surface of the beer, and at the same time is produced in such quantities as to be constantly making its escape, atmospheric air cannot possibly interfere.

About the year 1824, Mr. Gray, of Westham, on Madame Gervas's principle, attempted to introduce close fermentations into this country. It was tried in several places, but we have never heard of its having been permanently adopted. What may be denominated close fermentations are however, still practised in many parts of the country. When the worts are gathered together in the tun, a certain portion of yeast is added; the gyle-tuns are then shut up as accurately as circumstances will permit, and fermentation is allowed to take its own course, until the yeast falls to the bottom; thus trusting the whole process to chance.

The beer so produced is invariably what is technically denominated foul or yeast-bitten, leaving a nasty disagreeable bitter on the palate; a taste to those unaccustomed to it quite nauseous. It also, like all foul beer, stupifies without exhilarating, and produces, especially amongst sedentary people, heart-burn and head-ache. Custom, however, has so reconciled this unwholesome beverage to the palates of the consumers, that the stupifying quality is thought to proceed rather from the strength of the beer, than from its foulness from the yeast improperly combined with it, or perhaps sometimes from narcotics improperly introduced during the process. We trust, however, that other brewers, by following a more healthy process, and thus producing a better and more healthy beverage, will be able to convince those who follow the above-mentioned unwholesome and erroneous mode of fermentation, that a more scientific process must be adopted.

Of Long and Short Fermentations.

We have always contended that long fermentations are more hazardous than the shorter processes, it being understood that the temperature of the fermenting tuns can be controlled by proper means. It cannot be disputed, that when worts are kept a fortnight, or perhaps more, in the gyle-tun, they are much more liable to be injured by the different atmospheric fluctuations which may take place during that period, both with regard to the influence of electricity and temperature, than they can possibly be in a period of from forty to seventy hours, or sometimes less. If, therefore, equally good, or perhaps even better results, both as to soundness and flavour, can be produced by the shorter process, it must be preferable. It saves both room and expense. Indeed, we have known beer brewed by a short process of fermentation, entirely consumed before beer by the long process was out of the gyle-tun. If worts be partially unsound, and the proper quantity of yeast added for a vigorous fermentation, it will no doubt often lead to the boiling and other erroneous fermentations, which do not, in the slow process, assume an appearance so alarming to the inexperienced brewer as the rapid. We generally find, however, that where the causes of unsoundness have been traced and removed, and the quick fermentations introduced, they have been found to be not only much safer, but to lead to better results than any other, and they, in consequence, have been permanently adopted.

We know that vigorous fermentations always produce the best beer for consumption in warm climates. For stock beers, therefore, which have to stand the summer of this country, the same process will be found the more certain.

Skimming.

At what time the troublesome, tedious, and wasteful process of skimming the yeast off the gyle-tun was introduced, we do not exactly know. We have no doubt, however, that its introduction proceeded from unsoundness in the worts, and consequently fretful fermentations.

By frequently taking off the heads in a fretful fermentation, we no doubt ultimately produce a better appearance. This having been discovered, probably led to the general adoption of that system in certain parts of the country.

A better appearance of the head produced in this way will not, however, tend much to the production of better beer, unless the original cause of the prior ugly appearances have been removed. Indeed, we have seen beer which had been nearly a fortnight in the gyle-tun, undergoing the process of skimming, and having apparently a fine, close, yeasty head, but at the same time smelling and tasting sour. In other instances, we have seen beer left in the gyle-tun to flatten, as it is called; instead of which, however, the beer was gaining heat from a second fermentation, which had distinctly taken place without the brewer being aware of it. The further progress in acidification was then put a stop to, by removing the beer to a colder atmosphere.

Skimming is also attended by a considerable waste of beer, as those who practise it well know. It also generally prevents the possibility of keeping the tun-room clean, splashes of yeast lying all over. We have heard many brewers state their want of confidence in themselves to attempt a vigorous fermentation; and at the same time express their astonishment at seeing it gone through successfully. We are led to conclude, therefore, that inexperience and want of confidence have principally led to the adoption of slow fermentations and skimming.

Fretting Fermentation.

The fretting, or fretful fermentation, proceeds either from using stale or languid yeast. It is often preceded by unsound worts. The first indication is soon after the tun has creamed over. Instead of rising to a curling top, blue patches make their appearance in different parts of the head, and no proper light yeasty change takes place. In about eight or ten hours a sort of undulating motion is apparent all over the top of the worts, and soon after this the head, which has never been above three or four inches high, begins to drop, and is replaced by large and rather opaque air-bells, which always denote acidity.

There are various ways of making the appearances more healthy. But prevention is better than cure; and, as we have already stated, the causes may be easily traced and removed. The beer so fermented will be either mawkish or yeast-bitten, or perhaps both.

Yeast-bitten Fermentation.

As this term may not be thoroughly understood, we shall endeavour to explain its meaning. Some beer, when drunk, leaves a very unpleasant bitterness on the palate, which hangs there for a considerable time. This bitter taste is supposed by many to proceed from hops; the hop bitter, however, is quite different, being highly aromatic and pleasant, and, technically speaking, goes clean off the palate.

This disagreeable bitterness proceeds from using stale, languid yeast, which, instead of carrying on the fermentation properly, seems to get so incorporated with the beer, as to become a component part of it, which cannot be discharged, as happens after a proper fermentation. Such beer, therefore, must be injurious to all constitutions, but particularly to delicate females and sedentary people. It produces acidity on the stomach, consequently heartburn, and a stupifying effect without exhilarating.

Yeast-bitten beer often appears bright enough to the eye, and from this circumstance many people are induced to think it must be good, wholesome drink. The harsh disagreeable bitter, however, which hangs, for a length of time, on the palate, is at once perceptible to any good judge, and warns him against its continued use.

On the Acetous Fermentation.

As the fermentation of malt worts for making vinegar is generally carried on at a much higher temperature, than that commonly used for beer, it has been thought that this high temperature is absolutely necessary for their after acidification; and it probably in some way facilitates that change. This mode of working being peculiar to the manufacture of vinegar, has procured for the process the name of the Acetous Fermentation; but we know, that no more acidity is generated in the gyle-tun during the fermentation for vinegar than in that for beer, unless it proceeds from other causes. It is so far, therefore, only the vinous fermentation of a malt wort, to be converted into vinegar by an after process.

It is even doubtful, however, whether the after process can be properly called a fermentation; for at the time the greatest acidification may be going on, there is often very little appearance of effervescence or fermentation. The fermented wort is converted into vinegar by its being exposed in open vessels, to imbibe oxygen from the atmosphere, and the acidification appears to be accelerated by heat, which is obtained by exposure to the sun in summer, or from stoves in cold weather. But from exposure alone acidity would take place in time without any artificial heat being applied.

We are now treating of vinegar made from malt without reference to that made on the Continent from grapes or wine; but heat we believe is also had recourse to there to accelerate the same process. The vinous fermentation, in vinegar made from every vegetable matter, must, to a certain extent, precede what is called the acetous, as it is alcohol only which imbibes oxygen, and becomes acetic acid.

Chemists inform us that the acetous fermentation may set in during the fermentation of beer, after it exceeds a certain temperature in the gyle-tun; but they cannot afford any chemical proof of this statement. We have seen beer, the fermentation of which was begun at 80° F., and carried to upwards of 90°, and which beer at the end of twelve months bore the test of litmus paper as well as any Bavarian beer that has been met with by us, and this notwithstanding that the latter beer had never exceeded perhaps little more than half that temperature in its fermentation. It is proper, however, to add, that the former beer, as well as all the Bavarian beer which I have seen, wanted vinosity, and had a mawkishness in flavour which would not generally please in this country.

It is well known, and can easily be shown, that positive electricity excites acidity in worts or beer, while negative electricity prevents it. This accounts for the tendency to acidity in all beer which has been subjected to positive electro-chemical action in any part of the process of brewing, but particularly in the gyle-tuns during fermentation.

From what has been said it would appear that there must be some doubt as to whether what is called the acetous fermentation has ever as yet been properly defined; and, with all due deference to much higher authority, it seems at least very doubtful whether the term acetous fermentation is scientifically applicable to any stage of the process of converting beer into vinegar. At all events, no undue acidity takes place in the prior vinous fermentation, unless produced by galvanic action or other accidental causes.

Distiller's Wash.

In confirmation of the above, it may be stated, that distillers in the fermentation of their wash wish to avoid all acidity as much as brewers. It decreases the quantity of spirits from the still in proportion to the extent of acidification which may have been generated. Their fermentations, however, generally speaking, are carried on at as high temperatures, or nearly so, as those used by the vinegar-makers; but when successfully conducted, their fully attenuated wash will bear the litmus test as well as sound beer. When fully attenuated, however, they always find that the sooner they can be brought to the still, the better will be the produce in spirits. It sometimes happens, from accidents or other causes, that their wash cannot be distilled at the proper time, and thus by their being kept too long in the fermenting backs, although kept as much secluded from the atmosphere as possible, acidification begins to supervene, which is indicated immediately by an increase of specific gravity, and the produce in spirits will then be proportionally less and less, according to the time the wash may be thus exposed to atmospheric fluctuations. These few observations are only made in confirmation of what has been above stated; but as this is merely a treatise on brewing, we shall not at present enter further upon the subject, although distillers, from similar causes, are just as likely to be unsuccessful in their fermentations as brewers.

Further Remarks on Fermentation.

It happens sometimes in long fermentations, that although the heads on the worts assume in certain stages very unhealthy appearances, they afterwards, even spontaneously, become more vigorous and healthy; and this the inexperienced brewer assumes as a certain indication that all is right. He may rest assured, however, that if an unhealthy appearance takes place in any part of the process, it denotes either more than the common acidity in the worts, or acidity produced in the process of fermentation by electro-chemical action, or other causes. And, however healthy to appearance the fermentation may become, the beer, instead of being what is denominated "sound old," will fly off to an acid. This in a great measure accounts for the difficulty of procuring any really sound beer after it has attained a certain age. We have very often, on pointing out some very irregular appearances in certain stages of fermentation, been met by the remark, — "Oh! that is nothing; it will all be quite right before cleansing." The beer, however, notwithstanding its healthy appearance, will always retain a mawkish, subacid flavour, very disagreeable to those who have accurate palates, and also highly prejudicial to the health of those who drink it.

Many brewers, however, rather than allow their own knowledge of their business to be called in question, will persist in this erroneous mode of working; trusting that their beer will be all consumed before any of the anticipated bad effects can take place. Such brewers obviously look more to their own profits than to the health of the consumers.

Some remarks on Spontaneous Fermentation will be found in the APPENDIX.

PALE ALE.

The best Malt for Pale Ale.

Brilliancy and paleness of colour are the great desiderata with the public, in all high-priced ales. To have the desired paleness, the brewer is obliged to look out for the palest malt, and is often induced to buy such as has not been thoroughly dried on the kiln; or, if a malster himself, to take it off his kiln before the moisture has been thoroughly evaporated. If malt of this description be used in brewing, it will invariably be found to produce more acidity in the worts than when it has been thoroughly dried or *well-cured.* Indeed, the technical terms of *well* or *ill-cured* malt imply as much. To prove this it is only necessary to test the different worts with litmus paper, when running from the mash-tun. It will then be found that the worts running from the uncured malt, will tinge the paper of a brighter red than those running from the thoroughly dried malt; thus proving that there is more acid in the former than in the latter.

There can be no doubt, therefore, that the ale brewed from slack-dried malt (technically so called) will be much more apt to become acid than when brewed from that which is thoroughly dried or cured. Indeed, the double flavour of sweet and sour is often perceptible in the stronger ales, in a very short time, when they have been brewed with slack-dried malt, or with malt which has been allowed to imbibe moisture.

We trust enough has been said upon this subject to induce all brewers to be particularly careful, when selecting their malt, to avoid such as has not been thoroughly dried. After such malt has been chewed in the mouth, and squeezed between the thumb and finger, a rawness in the smell is quite perceptible, which is never the case with that which has been well cured. All such malt ought to be *re-dried* on a kiln until all moisture is expelled.

Hops for Pale Ale.

When brewing ales intended for long keeping or warm climates, it is perhaps necessary to be very careful in the selection of hops. The best East Kents, or North Clays, are considered as having the most preservative quality, being stronger than others. Many are in the practice of selecting the palest that can be procured, merely on account of their colour.

On the same principle, however, as with regard to malt, we recommend those of a fine straw-colour, as having attained greater maturity before being picked; and also as being better cured or dried upon the kiln.

Pale green hops are subject to the same exceptions as slack-dried malt, and may possibly to a certain extent be equally objectionable. For running beers, meaning those for immediate use, we have always found that fine Sussex or Worcester hops were equally good as the stronger Kents, if not, indeed, preferable to them.

The best Sussex hops, however, are so much improved of late, that they now nearly resemble the Weald of Kent: indeed it would be very difficult to discriminate between them; and we should as readily use the one as the other. Many are in the practice of using only yearling or older hops, or at least the greater proportion of such, in ales for immediate use, having an idea that the ales get sooner bright, and are less bitter. This is a mistake, as we have very often proved. The bitter complained of proceeds from the ale being yeast-bitten, or partially so; but the ale, if sound, will become bright equally as soon with the one as the other.

The increasing attention now beginning to be paid by the planter to the growth of the *male* or wild hop, and also having them more numerously distributed in the hop-ground, will rapidly increase the *productiveness* of the *female* or common hop which the brewers use, and also improve the *quality* of the plant.

SUMMER BREWING.

Brewing in summer has always been considered a very uncertain process: and both brewers and distillers find it impossible to carry on their operations during that season so successfully as in winter. The generally received opinion is, that the state of the atmosphere in summer, prevents fermentation from going on so successfully as in winter.

This, however, we do not admit. If the fermenting tuns be properly placed, and the worts are as sound when fermentation begins as they are in winter, along with sound yeast, the fermentation, with a properly regulated temperature, will go on equally well. The worts, however, owing to the state of the atmosphere, are more liable to get tainted during the process of brewing in summer, than they are in winter; and as already stated, the least additional acidity in the worts will always produce irregular fermentations. It is, therefore, the difficulty of preserving worts in summer, so as to go sound into the gyle-tun, on which the uncertainty in fermentation during that season depends; and not the interference of the atmosphere with the process of fermentation.

Art, by means of fans, refrigerators and regulators, has now enabled us to overcome, in a great measure, the difficulties formerly experienced.

Even now, however, with the assistance of all these new inventions, summer brewing is found to be very uncertain and precarious; and no one thinks of brewing more than may be absolutely necessary for immediate draught. The more speedily the whole process can be carried through at this season, the greater probability of success. The taps or worts should never be allowed to remain in the under-back, but should immediately be run into the copper for the purpose of gaining heat.

It has been already stated that the whole extract, of any value, must be made in the first mash, and that all we can afterwards do, is to wash out the saccharine remaining in the malt after the saccharisation has been thoroughly formed in the first mashing. There can be no use, therefore, in allowing the liquor to remain long on the goods in the after mashes. We should, consequently, proceed as rapidly as possible. To accomplish this, instead of adopting the mode of sprinkling or sparging, now so generally practised, it will be found, that by turning the same number of barrels over (not under) the goods as we should do for a second mash, the extract may be quite as effectually washed out as by sparging.

Some mode, however, must be adopted to prevent the liquor, by running too rapidly, making a hole in the goods or malt in the tun, so as to raise them without the liquor finding its way directly through them. This can be easily accomplished by placing a board or bit of canvass on that part of the tun on which the liquor directly runs. If the malt (or goods) rise through the liquor on top, which will invariably happen with good malt in the course of ten or fifteen minutes, the worts may immediately be set a running as rapidly as the false bottom will permit. If, however, the malt does not rise, which sometimes happens with inferior malt, a short mash must be resorted to, after which ten minutes' standing will be quite sufficient. Where two boilings are necessary, the quantity turned over, in this second mash, should make up precisely the quantity wanted for the first boiling. Where there are two coppers, there can be no difficulty in the after proceedings, but where only one, we must be guided by existing circumstances. The great desideratum in all our operations is facility. When we have a raw or return wort to follow, the necessary quantity of liquor for the second boiling may be turned on at once; but where no raw wort is taken, two or perhaps three washings are necessary to get the whole extract from the malt.

The third liquor, if the process be properly conducted, may generally be had from the copper, even although an open one: for the fourth and fifth we may with the greatest safety apply cold liquor; sprinkling, however, over the malt in the mash-tun a little common salt, or half the quantity of subcarbonate of soda or potash. As we have already stated, long boiling produces no preservative quality in the beer. Boiling for more than an hour is, therefore, unnecessary for the first worts.

The worts of the third mash should be allowed to run, when the copper of the first worts begins to boil, thus allowing one hour for preparing the second boiling. The time of boiling the second worts must be regulated, of course, by the strength of the beer we intend to produce. Where the worts are boiled off at one boiling, the same course must be pursued; the only difference being that the third tap may be allowed to run a good deal sooner. All this, however, will be more thoroughly explained, and better understood, by referring to the practical brewings at the end of this book.—See "Mashing" for calculating the gravities.

A very desirable appendage for summer brewing, is a refrigerator, for cooling the beer to a certain temperature, after having thrown off its yeast. Beer must be cooled down to a temperature of at least 60° F. before it will become bright.

We have not yet alluded to the necessity of cleanliness in every department, and in summer brewing particularly. In summer, every vessel employed should be well washed after every process, and once a week a solution of chloride of lime ought to be employed in doing so. We will now conclude our remarks on summer brewing, by again stating, that unsoundness in the worts, however produced, is the source of failure, and that the only remedy is to trace out and remove the cause.

WINTER BREWING.

It is a very common observation, that any one can brew in winter, and certainly the chances of brewing successfully are much in favour of that season. In the first place, there is much less risk of the worts getting tainted during the process than in summer: secondly, the yeast, which during summer will sometimes become unfit for use in a very few hours, is not in winter liable to any such speedy changes; and will even keep for weeks in good working trim: thirdly, the stagnant, or even running water, which, from necessity, is often used in brewing, is in winter much less impregnated with organic matter and impurities than during summer: and thus no such bad effects need be apprehended in cold weather.

If, therefore, the brewhouse be so constructed as to avoid electro-chemical agency, the chances (so called) are much in favour of winter brewing.

Even in this season, wherever any galvanic agency takes place, the process of fermentation is quite as irregular as during summer, and the results are equally uncertain.

In some brewhouses, particularly in the country, the tun-rooms, or chambers in which the fermenting tuns are placed, are so situated as to be affected by every change of temperature. The fermentations in the said tun-rooms must consequently suffer from any sudden change. The great danger arises from a very sudden fall; for instance, we often find that the thermometer will fall 20° or even 30° in the course of a night, and when the tun-rooms are so situated as to be liable to the same change from the sudden decrease in temperature, the fermentations will often become stationary, and cannot be made to progress, unless the temperature be again raised by artificial means.

For this purpose, it is a common practice in small concerns, to fill small casks with boiling water, and place them in the fermenting tuns, changing the water in the said casks, until the desired effect is produced. Others, where there are metal regulators in the tuns, run some hot water through them for the same purpose: this we have seen attended with bad consequences, whether from galvanism or not, we are not prepared to say. It is a practice which we do not recommend.

Mode of accelerating Fermentation when Languid.

A mode different from either, we have uniformly found successful; and it produces the desired effect much more quickly. A very slight rise in the temperature will again promote the fermentation; and the more speedily the required heat can be communicated, the better the effect.

If, therefore, brewing is going on next day, run a certain portion of either the first or second worts, as circumstances may require, into the stationary gyle-tun. Let them be as hot as possible; if only just off the boil, so much the better; about one gallon to a barrel, or even less may be enough.

If no brewing is going on, heat up the requisite quantity of worts, taken from the stationary gyle-tun, to the boiling temperature, or if there be no easy means of doing this, use in the same way about an equal quantity of boiling water. At the same time light a fire in the tun-room to raise the temperature. A little additional yeast set working at a temperature of about 80°, will materially assist.

STOCK BEER.

Of the proper Season for Brewing.

An opinion has long generally prevailed that October is the best month for brewing. Fermentation, however, is often found to go on as irregularly in that month, as at any other period of the year. It, perhaps, proceeds even more irregularly in this favourite month. This can only arise, as before stated, from unsoundness in the worts, which may proceed from the various causes already mentioned.

Where stagnant or running water is used in brewing, the fall of leaves and other parts of vegetables, either into the ponds or rivers, will, with the feculent matter already deposited therein, cause putridity, which must in a certain degree extend to the worts, causing unsoundness, and of course fretful fermentations. This will sufficiently account for any failure. After a good hard frost has taken place, the stagnant or running water may be used more safely, although good spring-water is always preferable.

In the families of noblemen or gentlemen who brew their own beer, October is often still preferred for that purpose. This, however, can be no proof of its superiority, as they generally brew with spring-water ; and their mode of brewing would not answer in a public brewery. They are in the first place very indifferent as to the quantity of malt used in brewing, and the worts are consequently of very high gravities. Their brewers being generally but imperfectly acquainted with the use of a saccharometer, and often even of a thermometer, must trust every thing to chance. The fermentations are, therefore, carried no further in the first instance, than to produce an unattenuated sweet-wort, which has to undergo a second fermentation before it becomes ale or beer. On the management of this second fermentation depends the quality of the said beer.

The worts being originally very strong, retain a sufficient quantity of saccharine matter to prevent the occurrence of acidification, unless exposed to the action of the atmosphere, and in temperatures which are too high, or to the action of galvanism or common electricity. When the second fermentation appears, the skill of the butler is required to give the necessary vent, and to rack the beer into other casks to stop the fermentation, when he thinks it has proceeded far enough.

It will thus appear, that, however fine we may occasionally see the beer which is brewed by private families, the whole process is a matter of mere chance, and could not be adopted with success in any public establishment.

From what has been said, it would appear that

October is by no means the best season for brewing stock beer, and when stagnant water is used, must be decidedly the worst. The season which we recommend for the purpose, is fine open frosty weather whenever that may occur, or when the temperature of the air is about 40° F. and clear, with N.E. winds and high barometer. The worts are then much less liable to become tainted than in rainy or hazy weather, and the fermentation will be more healthy and vigorous, and thus produce a sounder and better beer than can be obtained under different circumstances. Frosty weather may be expected from December till nearly the end of March: these four months, therefore, are the proper months for brewing stock beer.

All stock beer should undergo a vigorous fermentation: this cannot be accomplished with any certainty, by a slow process, as is sufficiently exemplified by the fact, that no brewer pursuing the slow process of fermentation, will guarantee his beer above a certain limited period, and even before the end of that period, it is often returned by the purchaser on account of unsoundness. Stock beer, therefore, of whatever strength, should never be more than from 50 to 70 hours in going through its regular process of fermentation in the gyle-tun. Skimming in this case is quite superfluous, as the beer, when cleansed at the proper time, will throw off the yeast in the cleansing cask, quite as well and perhaps much better for its preservation, than by any other process.

Slack Malt hurtful.

We may also observe that the malt generally used for brewing in Autumn, is that which has been kept over the season; and in many cases will be found to have got *slack* or moist from exposure to the atmosphere. Malt of this description, as already stated, always produces unsound worts, and consequently, unsound beer. Malt in this state should, therefore, always be re-dried on the kiln before being used in brewing.

REMARKS

On Want of Success from Change of Locality.

It has already been stated that a brewer, on going from one brewhouse to another, often finds it impossible to produce beer which is equally good in his new situation. This has been found to be the case even when all the materials have been furnished from the same stock. How is this to be accounted for? In days of yore it was attributed to witchcraft, and even now there are many who cannot otherwise account for it. Chemistry has, however, superseded witchcraft, in every process dependent upon its own laws. The process of brewing being strictly chemical from beginning to end, must be subservient to the laws of chemistry, and until these laws are understood and applied, no uniformity can be expected. In some chemical processes, the slightest variation will produce very different results. By using vessels made of certain improper materials in some chemical processes, it is possible to compound deadly poisons, instead of wholesome medicines. May not the same, to a certain extent, be true in the brewery? If we find that in one brewhouse, constructed in a certain way, every thing succeeds, while in others, differently constructed, nothing will succeed, have we not a right to suppose that this must be owing to the different construction of the said brewhouses? and that, therefore, the process of brewing must be pursued with reference to the proper chemical laws, in every respect the same as in producing the nicest chemical compounds.

Now, however, nothing is attended to in the construction of brewhouses but saving manual labour; by the introduction of a multiplicity of metal pipes, to prevent the possibility of any waste in the beer. We think enough has already been advanced in the chapter on Electricity, to point out the injurious effects of mixtures of metals in the construction of brewing utensils; and we have little doubt that a great proportion of the inferior beer which we now see, is produced by the electro-chemical action, proceeding from the above-mentioned mixture of metals. As brewing, therefore, is a strictly chemical process, the laws of chemistry, by which it can alone be safely directed, should be much better understood than they have hitherto been by all connected with the trade. There can be little doubt but that the art of brewing, like other arts, will hereafter be conducted on such scientific principles as may render it as independent of chance, accident, or locality, to which much importance is erroneously attached, as other arts in which the proper means have been adopted to acquire successful uniformity.

We often hear locality quoted as the only reason which can be assigned, that better beer is brewed in one district of the country than in others. Locality, so far as malt is concerned, may no doubt have an influence; some districts produce much finer qualities of barley than others, and of course, much finer and better-flavoured malt. The flavour of beer must of course depend on the quality of the materials which may be used in manufacturing it, and also on the mode of manufacturing it. No further importance, however, can be attached to locality; as we can always in any place find water sufficiently fit for brewing, and by a proper construction of the premises, form our own locality, as often has been and can again at any time be proved.

DRUGS.

Although, generally speaking, we object to all drugs in brewing, it would be folly to suppose that we may not occasionally find the benefit of resorting to such simple chemical remedies as may be found necessary, for properly cleansing the utensils, and removing unsoundness. Some distinct chemical knowledge is therefore necessary, as we might otherwise employ deleterious substances for these purposes. The practice of drugging is now rarely employed; and we know, that in London, no respectable house will, on any account, permit it. We have reason to think, however, that some country brewers are not so scrupulous; but are often over persuaded by ignorant quacks, to make use of such drugs as they may recommend, for the purpose of giving flavours. One drug is represented to make the beer keep, a very desirable object; and others are said to confer fine flavours, vinosity, &c. &c. Others, and those very various, are famed for giving the London porter flavour; and the ignorant brewer is induced to use them, from being told by those quacks that the great London houses do the same. We can assure these mistaken persons, however, that no great London house uses, now-a-days, any ingredient disallowed by law; and that no other flavour is given than what is produced by malt and hops.

When harmless ingredients are used for giving flavours, they cannot be particularly condemned: they however subject the brewer, when discovered, to the penalties of the law ; and on every account are rather to be avoided. When such drugs as cocculus Indicus, opium, tobacco, &c. &c. are used for giving a stupifying quality to the beer, every brewer using them must know, that besides subjecting himself to heavy penalties, he is doing gross injustice to the public.

It is generally supposed that the finest ale cannot be brewed without flavouring matter. This, however, is quite a mistake. The flavour of the finest Burton, Scotch, and other ales, proceeds chiefly from the care taken in selecting the best malt and hops, and the high gravities of the worts. These ales are from forty to forty-five lbs. per barrel gravity, by Long's instrument, or 1·111 to 1·125 specific gravity, by Allan's or Bates'. Whenever the gravities of worts exceed forty, a much richer flavour is produced than at lower densities. This accounts for the superiority of high-priced ales.

Any brewer using ingredients disallowed by law, subjects himself to information from any of his servants, who must no doubt discover it, and thus loses all command over them.

No respectable house, therefore, will now run any such risks, and we would strongly recommend it to all, never to be influenced by the opinions of ignorant quacks, who, knowing nothing about the matter, care only for their own interest.

Heading.

There is, however, one ingredient, called heading, that gives to porter a fine frothy top, which adheres to the pot or glass, when pouring out, or drinking the beer. It is sulphate of iron, commonly called salt of steel, which, when applied in such small quantities as will have the desired effect, can do no harm. One ounce of this is enough for four barrels; or one quarter of an ounce to a barrel.

This heading also imparts to the beer a sharpness in taste, generally liked by porter drinkers. The law, however, has imposed severe penalties on the use of it, and a test is applied for detecting its presence. The test alluded to is the *red ferro-cyanide of potassium.* As it is not a substitute for either malt or hops, and as people generally prefer porter carrying a good head, there can be no good reason for its being so severely prohibited.

Of Mixing Beers.

The process of mixing beers is technically denominated "*marrying*" them. This process is seldom attempted with mild ales, but with the more hardy beer called porter, it is very generally practised. Mild beer is now become the order of the day; and old beer, excepting when mixed with new, is seldom drunk. The uncertainty of brewing, the reasons of which we have attempted to explain, occasions a great deal of beer to be returned by the publicans to the brewer, principally in summer. These returns are stowed in vats, where they are allowed to remain until they are thought to be in a fit condition to be mixed with mild new beers, the only way by which they can be got rid of. This is occasionally done by breaking the old beers into the gyle-tuns with the worts, while in a state of fermentation, which is a very dangerous mode of working: for if the fermentation should be in the least degree languid, the addition will make it more so, and the whole gyle, or brewing, will be unfit to be sent out. This injudicious plan has sometimes been followed to such an extent, as to block up the brewer; that is to say, he at last accumulates such a quantity of unsaleable beer, as not to leave room for brewing any more, until, perhaps, he has been obliged to turn some of his stock down the kennel. Others break their old beer into the breaking batch (or vessel into which the porter is run before being pumped into the vats) with the mild beer. This mode of working may also be unsafe; for unless the fermentation has been vigorous and healthy, and the old beer brought into a fit state for mixing, no combination will take place; the beer will retain a double flavour, and be occasionally unfit to be sent out, unless by being brought into proper condition, and again mixed off with mild beer. From the above remarks, it will be seen that marrying or mixing beers is a very dangerous process, unless when thoroughly understood by the operator.

Old beer can never be in a proper state for mixing off, unless when brought *round* (as it is called) for that purpose. This can only be done by again bringing it into a state of fermentation in the vat: after which, if properly treated, it will generally become bright and sparkling; that is to say, if it has not got so bad as to be totally irrecoverable, or unfit for use in any way excepting in making blacking. It will then at once combine with any sound mild beer, and, instead of injuring, will improve the flavour. Judiciously to bring on the above-mentioned fermentation in the vat, and at the same time so as not to carry it too far, requires a good deal of skill, and can only be accomplished by those who have been accustomed to such management. Where the process of fermentation is properly and scientifically conducted, these artifices, rendered necessary generally, by neglect or ignorance, will seldom be required.

STORING AND KEEPING BEER.

The best and most proper mode of storing and keeping beer is well worthy of the greatest attention. There are, however, many contradictory opinions upon this subject. Some think that all beer, but particularly ale, should be flattened, as it is called, before being stored in vats or casks. For this purpose, where slow fermentation and skimming are practised, large open vessels or tanks are provided, into which the beer is run, after having been a sufficient time, as it is considered, in the gyle or fermenting tun. The ale or beer is allowed to remain in these vessels for a longer or shorter time according to the fancy of the brewer or storehouseman. It is during this period imbibing oxygen from the atmosphere, and sometimes is allowed to remain there until acidification has distinctly commenced, as indicated by white spots appearing on the surface, and by an increase of temperature. The brewer who adopts this practice, thinks the beer is so much flattened as to prevent its fretting in the vat. It will be found, however, that although the beer, from some little decrease in temperature by its removal, may be quiet enough for a time, yet the least increase of heat or exposure to the atmosphere, will again set it in motion; when, by getting on the fret, acidity may be produced. It never can be thoroughly sound, and will very soon become flat in drawing. It will also be found that when beer has been too long flattened in this way, before being stowed in casks, it will very soon get flat and forward when in draught in the publicans' cellars.

This, therefore, must be a very erroneous mode of treating beer. Some brewers, who have no tanks for the purpose, pump their beer from the cleansing casks again into a fermenting-tun, where it is often allowed to remain until the same indications of acidity, as above mentioned, may have taken place, when the same bad consequences may be dreaded. One great complaint is, that though ale tastes very well when first tapped, yet it very soon gets flat and forward, and will not stand the draught. How can it, we may ask, when acidification has previously commenced by long exposure to the atmosphere?

We think enough has been said to prove that long exposure of beer to the atmosphere is the worst mode of treating it. The laws of chemical science, not less than the facts, establish this conclusion.

When beer of any kind has gone through a regular and sound process of fermentation, and has had full time to throw off its yeast, and get quiet, which will always happen in a few days; any further exposure to the atmosphere is not only useless, but injurious.

It should, if sufficiently cool, (say about 52° F., which all stock beer must be on the third day after cleansing, when brewed in proper season,) be pumped into the vat; the bottoms which are pumped over along with it, will soon fall down, proving rather a preservative than otherwise.

The vats, when full, should be covered, and sand thrown on the cover, more effectually to exclude the atmosphere. A loaded self-acting vent-peg fixed in the top, would, however, be very desirable, so as to permit any elastic gas which may be produced to escape.

If the storehouse can now be kept at a regular temperature, no other precaution is necessary; but when liable to be affected by summer heats, the sand on the top of the vats should be sprinkled with common salt, which retains the moisture, and also be kept damp with water. This by evaporation will tend to keep the beer cool. When the beer, instead of being vatted, has to be stowed in casks proper for sending out, they should be conveyed to the storehouse, and placed upon wooden bearers; then, instead of the bung-holes being left open, which is the common practice, bungs should be inserted slightly, so as to be easily thrown out if necessary. Holes should also be bored into every cask, either through or near the bung, and spiles or pegs inserted, so as at any time to give vent, should that be required. After having given vent, however, the bungs or pegs should be immediately replaced. By this treatment the beer, if properly brewed, will very soon become quiet, and if not exposed to higher temperatures, will require no further attention until it is sent out.

ON THE WANT OF UNIFORMITY IN THE QUALITY OF BEER: ITS CAUSES, AND HOW TO BE AVOIDED.

LONDON has always been celebrated for the peculiar flavour and excellence of its porter; for a long time it was supposed that this was mainly attributable to its being brewed with the water from the Thames; but as Thames water has for a long time ceased to be used in brewing it, that supposition has been abandoned. As each establishment, however, has its own peculiar flavour, and differing in some respects from all others, it becomes difficult to say which is the right London flavour; and we greatly doubt whether any jury of twelve would agree upon this point: each would, very likely, give the preference to that he had been most accustomed to.

This variety of flavour is produced partly by the different grists used in brewing,—some using blowen malts for colour and flavour, others roasted malt only, for the same purpose; and perhaps, also, from the different modes of fermentation which may have been adopted by each, but certainly not from the use of drugs, which has been often supposed.

It was afterwards imagined, that what was called the real porter flavour, could only be acquired by brewing it in large quantities at a time. As it has now been proved, however, that porter as good at least, can be made on a small scale as a large, that prejudice also has been done away with. Although we entirely disclaim all intention of giving offence to any one in particular, it is impossible to avoid remarking on the want of uniformity, and the inequality of the beer now generally produced, and which of late years have been so generally complained of by the public. In our article on Electricity, it is, we believe, pretty well proved by facts given from actual practice, that voltaic or electrochemical action, is injurious to beer in every stage of its manufacture, but particularly so while undergoing the process of fermentation, as can be easily ascertained by the litmus test which indicates acidity. Indeed, it can be proved by the same test, that an increase of acid is often generated in the gyle-tun, and hence the tendency to increased acidity, when the beer is afterwards put on draught in the publican's cellar.

There can be no doubt, therefore, that where-ever the gyle-tuns are embedded in the ground, great uncertainty must accrue from the frequent electrical changes of the earth and atmosphere. The same uncertainty will exist when the gyle or fermenting tuns are lined with different metals; but when chains of pipes called mains, consisting of various metals, are connected with the gyle-tuns and cleansing casks, the positive electro-chemical action must be such as invariably to produce acidity to a certain extent during its fermentation, and thus cause the injurious effects above mentioned. This injurious effect is shown by the light yeasty heads rising to an uncontrollable extent (no close yeasty heads can ever be attained). This, however, is thought by some to be a sure indication of a fine, healthy, and vigorous fermentation; instead of which, however, it will be found that such a degree of acidity is then being generated as will prevent the beer from keeping, as it is technically called, nor can it ever arrive to be what is called really *sound old* — an article now as difficult to be obtained as it is much wanted.

Such are causes enough for the actual uncertainty in the quality of beer, and sufficient also to lead to the returns of those large quantities upon the brewer, which, in order to get rid of, must afterwards be mixed *or married* with other beer, thereby deteriorating its quality, even were it otherwise previously good.

When beer of the above description is exported or sent to a distance, it also must be returned upon the brewer, or ruinous discounts given to the purchasers to prevail upon them to retain and get quit of it how they best can, which is very often done. The causes of error being thus explained, the remedy is obvious; nor can the irregularities cease until their causes be removed.

Causes of the prevalent Complaint that the Beer did not keep last Season.

During the last year (1845), it was very generally remarked by brewers that the beer did not keep so well, or in other words, got sour much sooner than usual. Various causes were assigned for this: some thought it proceeded from inferiority in the malt, owing to the barley not being so good as in former seasons; others ascribed it to the wetness of the season, and by many it was attributed to electrical influence, &c. Perhaps the whole of these causes might more or less have tended to produce the evil complained of. There may, however, be another cause, which very probably has done as much harm as all the others put together.

The author, in the former part of this work, has endeavoured to put brewers on their guard against the consequences of the evil he now alludes to, and to this he will now more particularly advert.

During the last year, owing to the rather unusual quantity of rain, the atmosphere was in general much more humid than in most seasons; the malt also, as before stated, was inferior in quality to that of other years, and consequently had a tendency to imbibe more moisture than it would otherwise have done, and nothing but great care in keeping it would prevent its doing so.

It is now well known that, when malt, from exposure to the atmosphere gets in the least damp (or slack as it is called), any beer brewed from it will not keep, but on the contrary will very soon get acid or stale; it is more than probable, therefore, that last year's malt having got slack from bad keeping and the dampness of the air, was the principal cause of the beer made from it going off in the course of the season. The author had many applications respecting this, and invariably recommended the re-drying of the malt before using it, and when that was thoroughly done, it was generally found to be a considerable improvement. How often do we find brewers anxious for a little new malt before it can be brought to market? The same beneficial effects will be produced by redrying the malt, as this, if properly done, will answer equally well, and if the malt be sprinkled with a little water when put upon the kiln, it not only tends to lessen the decrease, but makes it taste as well and as brisk as if it were new. Maltsters generally strongly object to redrying, both on account of the expense and the decrease of measure, and consequently expect to make a charge for it; but the additional extract obtained, and the superior quality of the beer, will more than compensate for the extra expense. It would indeed be desirable on all occasions where malt has been kept over the season, without being entirely excluded from the air, to redry it before using, particularly when stock beer or that for exportation is wanted. This treatment will always make safer work, and perhaps prevent those complaints and losses, which might otherwise occur. It may be objected that redrying makes the malt a little darker in the colour, and of course the ale also. This, however, will be no objection to good judges, and real ale drinkers; all they look to is brilliancy, soundness, and fine flavour, and if the colour pleases them, others will soon yield to their opinion, and ale of a pure amber colour, as being generally more sound, will always be preferred by real judges to that which is paler. Fashion in this, as in other things, has very much altered since our forefathers were wont to sing, — " Now we'll quaff the nut-brown ale," &c.

It may be proper to remark here that very pale malt is seldom thoroughly sound-dried (or *cured* as it is called, a very expressive term), which is very probably the cause why so much of the pale strong ale which is brought to London never stands the summer.

It may also be remarked, as showing the absurdity of fashion, that many people who are accustomed to drink very pale strong ale, will not drink any of the weaker qualities unless they be of a much higher colour than the other, having an idea that it cannot have any strength but when it is of a darker colour.

FININGS.

All sorts of beer, if sound and well brewed, will, in due time, become bright; but when drank so new as is generally the practice, fining is absolutely necessary to give it that brilliant transparency which is so pleasant to the eye, and without which the best beer would be objected to.

The most efficient fining for beer which we have yet discovered is isinglass; the best of which is obtained from the sounds of the sturgeon, a fish found in the Danube, and rivers of Muscovy. In this country an inferior sort is prepared from the sounds of cod-fish, or ling; or, indeed, from any other fish: and also from the skins of soles.

The best isinglass is nearly all gelatine, and contains ninety-eight parts in every 100 which are soluble in boiling water. Isinglass varies in price from 1*s*. 6*d*. to 16*s*. per lb. There are various modes of ascertaining its value: and we extract two modes from a paper on the subject by Mr. S. Roberts, in Dr. R. D. Thomson's Records of Science, No. 14., pp. 106, 107.

" A great variety of isinglass is offered for sale, at a range of prices from 3*s*. to 16*s*. per pound; and the relative value of each kind may be known by the following tests: —

" In the first place, isinglass should remain unchanged, by being steeped in spirit of wine or alcohol, from 50° to 60° over proof, in which gelatine (the chemical principle of isinglass) is insoluble. The alcohol, or spirit of wine, in which the isinglass has been steeped, should then be tried with a few drops of tincture of galls; if the liquor remain clear and unchanged, it is much in favour of the character of the isinglass. If, on the other hand, the tincture of galls causes a precipitate from the alcoholic liquor, the isinglass is not pure, as it contains something more than pure gelatine.

" Different samples of isinglass, which have remained unchanged in alcohol or spirit of wine, should also be tried by the two following methods, before an opinion can be given as to their relative value. Try given weights of each sample (one-eighth of an ounce, for instance) in three ounces of water by measure, in separate vessels; bring them gradually to a boil, occasionally stirring each sample. While hot, strain the different solutions through muslin, into separate vessels. In proportion to the quantity of undissolved matter left upon each strainer, may the solubility of the different samples be ascertained; that which leaves the least residuum will form, when cold, the strongest jelly, upon which the clearing property of isinglass depends. The remaining trial to which the different samples are to be submitted, is the last and most decisive one. Equal weights of each sample (the one-fourth of an ounce, for instance) are to be cut into very small pieces, and each one-fourth of an ounce put into half a pint (imperial measure) of hard or sour beer, and the several vessels containing the different samples put into an apartment, at from 65° to 75° F., and allowed to remain there for three days, stirring each sample very well, once or twice a-day.

" At the expiration of that time, there will be an evident difference in the strength of each jelly, provided different qualities of isinglass had been submitted to the experiment ; and when the thickest jelly has a small quantity of the tincture of galls applied to it, and stirred through it, it will separate the gelatine from the sample of isinglass in the form of a thick jelly. The other samples which afforded a less solid jelly will give, with tincture of galls when stirred through it, a smaller quantity of gelatine in the form of thick jelly.

" From the strength of the jelly given by any sample of isinglass steeped in the above proportion of sour beer (such as brewers use in making clearings), and submitted to a temperature *not exceeding* 75° F., may be ascertained the relative value of that sample, as upon the strength of the jelly, and, consequently, the quantity of gelatine contained in any isinglass, depends its value in clearing malt-liquor. The best short-staple isinglass is always soluble in boiling water to about $\frac{1}{50}$ residue."

From the following quotations, however, it will appear that there are objections to the use of isinglass in fining beer, except for immediate use. Berzelius, who had discovered a small quantity of lactic acid in all animal fluids, and in muscular fibre, gave it as his opinion, in 1834, that lactic acid is produced in all fermentable matter. This suggestion has been confirmed by Vanden Ghyen of Ghent, who has extracted it from the beer of Diest: De Koninch has obtained the same acid from the brown beer of Malines. One litre of the beer of Diest afforded 2·20 grams of syrupy lactic acid. (L'Institut, 284.) " M. Fremy says that the internal membrane of the stomach of the calf is capable of transforming any aqueous solution of sugar into lactic acid." (L'Institut, 286.)

" M. Gay Lussac cautions, however, against the conclusion, that this change is an organic one, since it is possible that the transformation may be due to an action purely chemical between the saccharine and organic matter. Indeed, we know that lactic acid is in many cases produced by the contact of animal with vegetable substances." (L'Institut, 288.)

Mode of preparing Finings.

Having thus stated objections which may be raised as to using isinglass for fining beer, we shall give the mode of preparing it for use. Chemists state that gelatine is dissolved in liquid alkalis. The common mode, however, of converting isinglass into finings for beer, is by dissolving it in the first place by acids. Let any quantity be taken which may be thought necessary according to the magnitude of the brewery, and placed in an open-headed cask: if cut into shreds it will dissolve the more quickly. Let it then be covered to the depth of five or six inches with vinegar, which is the best solvent, or with very acid old beer. When the isinglass has swelled up so as to have absorbed all the vinegar or old beer on the top, more vinegar or old beer must be added, again covering the mass to the depth of five or six inches: the mixture should then be vigorously stirred with a hard broom, and the same process repeated as the isinglass goes on swelling, until the whole becomes of the consistence of pulp or thick jelly. Whatever quantity may then be wanted for use, may be taken out and put into another open-headed vessel, where it is to be mixed up with weak bright beer (generally brewed for the purpose), until brought to its proper consistency for use. This should then be strained through a fine hair-sieve by rubbing it through the sieve with a hard hair-brush, into another open-headed vessel: the portion which cannot be passed through the sieve may be returned to the first vessel, until again wanted. No more vinegar or old beer should now be used; the isinglass in the first cask must still, as it keeps swelling and thickening, be thinned down with the thin bright beer, until in a fit state for being passed through the sieve as before, and the quantity wanted for immediate use can at any time be made as before directed.

How to be Used.

When finings are properly made, they should be transparent, and no undissolved particles of the isinglass should be seen in them: the specific gravity should not be above 1·025. All sound well-brewed beer will readily become bright with finings as above described; but there are other sorts of beer which will not be rendered bright by any finings, and in this case, finings will be rather detrimental than otherwise. If, therefore, there should be any doubt as to the aptitude of the beer to take finings, it should in the first place be tried. This may be done by taking a small quantity of the beer from the vat, or whatever other vessel it may be contained in, and putting it into a long glass vessel made for the purpose. To this add a teaspoonful or more of the finings; it must then be shaken so as to mix thoroughly the finings with the beer; if the beer is sound, and has been well brewed, its aptitude to become bright will be soon shown, by the mixture becoming thick and curdy: a bright portion will generally make its appearance at the bottom or middle, and the finings will gradually mount up to the top, taking all impurities along with them, and leaving the remainder brilliantly bright. It has by some been stated that the finings should have a contrary effect, and at once carry the impurities from the top to the bottom. This, however, is a mistaken idea, and only takes place with what is called stubborn beer, and which will not become thoroughly bright whatever quantity of finings may be added to it. Should the sample in the glass become bright, there can be no doubt that the bulk will be affected in the same manner; but if not, there can be no advantage in applying finings, as they must produce more harm than good.

The more pure the isinglass, the more finings can be made from the same weight. Some are in the practice of dissolving the isinglass in boiling water to make finings; this is not only a very expensive, but also a very erroneous mode of proceeding, as the finings, when thus made, will immediately coagulate upon being applied to the beer, and at once go to the top or bottom without producing the desired effect. It may be observed that hot water, warm beer, or even steam, when applied to isinglass, does not hasten the solution, but on the contrary, hardens it, converting it into a dense fibrous mass, from which very little fining can be obtained.

ROPINESS.

ALE and beer are sometimes liable, when long kept, to become thick and viscid, pouring out like oil. This defect is called ropiness. Beers, when long stored in the cask in a fined state, are liable to undergo this change, owing to the small portion of gelatine left in the beer. It is, therefore, more advisable to store beer in the *rough* or *unfined* state. Ropiness in this case proceeds from deficiency of tannin, and superabundance of gluten. Hops will supply tannin and thus effect a cure. Catechu, which is almost all fine tannin, might also be used; but hops are to be preferred. Ropiness is often produced by the injudicious mixture of old and new beer.

OF HOP DREG IN THE WORTS.

MANY brewers bestow great care in preventing any of the dreg from the coolers running into the gyle-tuns with the worts. This is a mistaken caution, for it will be found that the hop dreg is a great preservative of the worts in the coolers, and when swept into the gyle-tun along with them, it acts as a preservative in the same way until the fermentation has commenced, and by thus preventing acidification, admits of a better fermentation than could possibly be produced if any unsoundness had taken place. It is well known that worts, while they remain on the hops, are much less liable to become tainted than when drained off. On the same principle, a little of the fecula of the hops is a preservative in the coolers; and the greater the quantity that goes over, the less risk of taint, particularly when the dreg is kept floating about in the worts by agitation in the coolers. It may sometimes be necessary, when the worts have remained for some time in the hop-back, to rouse gently the hops in the back, for the purpose of throwing over a little more of the fecula into the coolers than would otherwise have run over along with the worts. This, when once tried, we have no doubt will be adopted.

OF GREY BEER.

As many people are unacquainted with what is meant by Grey Beer, it may be necessary to describe its appearance. Most people, before drinking beer from a pewter-pot, blow off the frothy top, and if, on looking down, it appears quite black in the colour, they say it has a good face; on the contrary, if it exhibits a colour something like whey, it is pronounced to be Grey Beer, and is, of course, faulty. Grey Beer, when viewed in a glass by transmitted light, (that is, when looked through between the eye and the light,) may appear pretty bright, but never brilliant. When examined in the same way by reflected light, (that is, when the observer holds the glass before him with his back to the light,) its appearance will be grey or whey-coloured, and no good judge will drink it.

Greyness undoubtedly at all times denotes an imperfection either in the materials used, or in some part of the brewing process, for which no after remedy has, as far as we know, been yet discovered, at least without destroying the beer. There can be little doubt, however, but that it proceeds from a portion of imperfect starch, or rather perhaps hordein, remaining undissolved in the beer, for the chemical tests which have been applied confirm this opinion. Another confirmatory proof is, that distillers' wash (which is brewed principally from raw grain, with only a small portion of malt) is invariably of a greyish or whey colour after undergoing the process of fermentation. This arises no doubt from the imperfect action of the small quantity of diastase contained in the malt, on the excess of hordein contained in the raw grain. This being the case, there can be no doubt that ill-made malt, or the admixture of raw corn, will produce Grey Beer. An erroneous mode of making the extract will have the same effect.

If in the first mashing the temperature be not sufficiently brought up, so as to act properly upon the diastase, the extract must be imperfect. Should, on the contrary, the temperature be taken too high, the first tap will hang, that is, it will not drain clean off from the mash-tun. If taken much too high, the goods will set, as already explained. Many brewers think, that by using very high temperatures in the last mash or for return worts, they get a little additional extract from the malt. This, if it be so, can only proceed from the solution of a small portion of the hordein, which is always more or less left in the malt, according to its quality, and which, without these high heats, would not be acted upon. This additional extract, however, will be found at all times more detrimental than useful, and should never therefore be attempted.

As any of the above-mentioned causes may produce Grey Beer, the greatest care and attention is absolutely necessary in making the extract. But if the rules as laid down in this treatise for mashing be strictly adhered to, none of the above-mentioned errors are likely to take place, and the risk of having Grey Beer will consequently be greatly diminished.

Beer, when brewed from malt which has not had time to get cool after being taken off the kiln, very generally becomes grey.

CASKS.

Seasoning new Casks for Use.

As new oak staves contain a considerable quantity of gallic acid and tannin (tannic acid), it is advisable to remove these acids from new casks, lest they should impart a disagreeable flavour to any beer with which they may be at first filled. Many methods have been resorted to for *seasoning*, as it is technically called; but after having tried most of them, we have found that the best and most certain way is to neutralise the acid by means of an alkali; and for that purpose a solution of *quick lime* in warm water will be found perfectly efficient. Fill the casks with boiling water, into which introduce about 1 lb. of quick or unslacked lime in powder, which is more than the water can dissolve; then immediately bung the casks close, and roll them about. Let this mixture remain in the casks two or three days, rolling them about occasionally. The casks may then be emptied, and the lime be carefully washed out with several changes of boiling water, after which the casks may be safely filled with beer. To those who choose to incur that expense, sub-carbonate of soda or potash may be used, perhaps rather more effectually; but we think that quick lime, which, being cheaper, can be more easily obtained at all times, will be found sufficient for the purpose.

A *woody* flavour is sometimes given to casks, and is said to be derived from the *firing* of the cask by the coopers. All such casks should be well *grouted* after the firing, before being filled with beer.

Cleaning Musty or Stinking Casks.

When too much fire is applied in making up casks, it raises blisters in the interior of them. These blisters, if not removed, very soon produce mustiness from the filth which gathers under them. They should, therefore, be all cut out with the cooper's iron, and until this is done, the casks cannot be effectually sweetened. A solution of chloride of lime (bleaching powder) in boiling water will then have the desired effect. Put about twenty or thirty gallons of boiling water into a butt, or less in proportion for smaller casks; then throw in a few ounces of chloride of lime, according to the size of the cask, and then pour in an ounce of muriatic acid (spirit of salt mixed with water) to evolve the chlorine gas rapidly. Bung the casks closely as soon as possible, to prevent the escape of the chlorine gas. Roll the casks about, when the gas, by penetrating the pores of the wood, will very soon remove all remains of mustiness.

Tainted *vats* or backs are rendered sweet, and fit for use by washing with diluted sulphuric acid, and afterwards with lime water, and then pure water.

In the London porter breweries all the butts and other casks, if long kept and not sweet when returned, as from the country, are *steamed*, after being washed with boiling water. After the steam-ing, in which the force of the steam is considerable, they are again washed with hot water.

It is a curious fact, that *musty* beer is generally bright: this circumstance is not easily accounted for.

GENERAL SUMMARY.

To any one who has attentively perused the foregoing pages, it will appear that want of success in brewing, must be due to other causes than those to which it is generally attributed, viz., the great uncertainty attending the process of fermentation.

If it be admitted that brewing is a chemical process, it must be subservient to the same laws which govern other chemical operations; and, under precisely similar circumstances, the same effects will necessarily be produced.

If, therefore, we succeed in one instance, nothing but diversity in the materials used, atmospherical changes which may be counteracted, or in some part of the operations performed, can prevent our arriving invariably at the same results.

Fermentation is undoubtedly as delicate a process, and perhaps as little understood, as any other connected with chemistry; but upon a regular and successful fermentation, or the contrary, must depend the good or bad quality of the beer. Such trifling causes, however, affect this process, that a brewer must not only have a distinct and extensive knowledge of chemistry, but also be what is termed a good manipulator, with great skill in the operative department of the business, before he can reasonably expect to brew uniformly good beer.

How often do we hear brewers say, "We cannot account for our want of success in this brewing, as it was conducted in every respect precisely the same as one last year, and designed to produce the same kind of beer, which then turned out remarkably well." They never, however, think of the different state or temperature of the atmosphere, which, by requiring the worts to remain several hours longer in the coolers, may occasion *acidity*, and thus produce the difference in quality. A change in the construction of the utensils, may, from various causes, have an equally injurious effect; besides many other casualties.

As already stated, brewers possessing a good and accurate taste and smell have a great advantage over those who in these respects are defective, as they are thereby enabled at once to discover acidity or unsoundness in the worts. Litmus paper, however, if properly employed, will in some measure compensate, as it also enables them to make the same discovery; after which, by immediately applying the proper remedies, the injurious effects may be obviated which would otherwise be produced.

The principal danger is always to be apprehended from electro-chemical or galvanic action; which we have not as yet found any other means of counteracting, than by removing the cause. By this action, whenever it exists, we are opposed from the beginning to the end of the process; and during its continuance, no regularity or command over the fermentation need be expected. We cannot, therefore, be too careful in the construction of new brewhouses, or in the alteration of older concerns, to avoid all mixtures of metals in connection with the utensils, and particularly with regard to the fermenting tuns.

This subject has been but very little attended to; and we believe that we have been among the first to investigate and draw the attention of brewers to the injurious operation of electro-chemical action on the process of brewing; and we trust that what we have now written, may be the means of inducing brewers assiduously to examine this matter. With this view, we cannot sufficiently recommend to them the use of the *Galvanometer*. Good manipulation also in the process of brewing, is quite as necessary as in any other chemical operation.

Many of our most eminent chemists are bad manipulators; and have been, consequently, very apt to fail in exhibiting certain experiments. Even the great Sir Humphry Davy admitted that he himself was a bad manipulator, and we have heard that upon one occasion, after having frequently tried an experiment and always failed, which he was quite certain must have succeeded if properly managed, he submitted the case, when accidentally in Edinburgh, to one of the chemists in that city. By him the experiment was immediately performed with success. Sir Humphry then remarked, that he had made more discoveries by his own bungling in manipulation, than in any other way; the failures having led to new results of a nature different from what he had anticipated.

Bad manipulation in brewing, although not likely to lead to any beneficial discoveries in that art, may be followed by equally bad effects, as in making chemical experiments. Many brewers, for instance, think it a matter of but little importance, should they be a few hours longer in making their extracts, at one time than at another. This, however, will frequently produce acidity in the worts, and consequently fretful or irregular fermentation. Others think that success in brewing depends wholly on the first taps or worts running brilliantly bright from the mash-tun, (a matter of no great importance,) and adopt measures for attaining that object, which are often very injurious.

Many other instances of carelessness and want of method might be quoted, which would sufficiently account for the various anomalies taking place in fermentation. Such *seemingly* unimportant matters, however, are seldom taken into account; and want of success is attributed to causes over which it is supposed we have no control, and of course cannot understand. The same difficulty, indeed, occurs to experimenters in chemistry. A bad manipulator is often surprised by want of success in his experiments, when another operator, of scientific qualifications perhaps greatly inferior, is invariably successful.

To want of method, therefore, or bad manipulation, may be ascribed a great portion of the uncertainty which occurs in fermentation.

Another circumstance may here be taken into consideration. In making certain colours, a bright sky and a dry atmosphere are best adapted for producing brilliancy. The want of these auxiliaries in this country is so influential that we are seldom able to rival the colours made in Italy, or in other countries possessing these important advantages. We find, however, that in countries possessing the necessary requisites for making colours, the process of brewing beer is seldom successful. This may proceed from a different state of the atmosphere producing acidity in the worts, more readily than in our more northern climates. We should accordingly, even in this country, avoid all exposure either of the worts or gyle-tuns to the solar rays, or even to much light.

Irregularity or want of uniformity in the process of fermentation, as before stated, proceeds from such apparently trifling causes as to make it quite impossible to enumerate or describe them. We may rest assured, however, that if we succeed in any one fermentation, every failure in our future processes must proceed from want of method, bad manipulation, or other impeding causes, which may be traced, and may unquestionably be removed.

But let us dismiss all pretended secrets, as well as adages, new hard names, old saws, and dogmas, which we are sorry to see still quoted as rules for guiding the maltster and the brewer, although these dogmas still appear in works written professedly for the purpose of giving scientific practical information, yet do they abound in such high-flown, mystical language, as would not only, by their obscurity, puzzle the reader to comprehend, but the authors themselves to explain, were they so required. Let us have done with all these sources of error and confusion; and instead of looking upon brewing as an art which proceeds without obedience to regular laws — differing, therefore, from every other chemical process — let us endeavour, with the advice and assistance of men of science, to trace out the laws by which this art *must* be governed: and thus effectually remove the reproach, that any ignorant pretender may be more successful than those who think themselves, and indeed who really are better acquainted with the subject. There is still in this art a great deal to learn: and although possessed of moderate chemical knowledge ourselves, we have gratefully to acknowledge the advice, assistance, and information we have readily and uniformly received from every scientific gentleman to whom we have applied on the subject.

Instead, therefore, of throwing away money for the assistance promised by the secrets of empirics, let brewers adopt the superior plan of applying to men of science when any difficulty occurs, and we have little doubt they will be courteously received, and the required information be freely imparted.

In the foregoing pages, we have endeavoured to explain every thing connected with the process of brewing, so far as we are yet acquainted with it; and in language so plain, that we trust it will be intelligible to readers of every description. If we should have failed, the reader may rest assured that the obscurity does not proceed from any intentional reservation, but merely from inability to be as clear and explicit as we desire.

We hope that we have assisted in laying a foundation for scientific enquirers; which, if properly employed, may lead to more uniform and certain results than have hitherto been thought to be attainable. And we do think that in the production of an article so indispensable to the working classes as beer is now considered, no exertion should be spared to produce it in all cases of the very best quality.

We have only further to add, that this treatise is based entirely on our own practice, without reference to the opinions of other writers on the subject; during which, in many and various situations, we have had opportunities of seeing very different modes of working — and that in most instances we have found, that where brewing was not conducted successfully, causes existed which might be traced, and which, when traced, might be removed with certain advantage to the brewer; and having stated only that which we have already ascertained to be true, we are persuaded that the whole will be confirmed by the results of well directed and scientific practice.

APPENDIX.

PRELIMINARY REMARKS.

In the first edition of this work, tabular illustrations of different brewings were given. It has been suggested to the author, that a few detailed formulæ of processes of different brewings, from the beginning to the end, would afford better and more distinct information to young brewers, or those but little acquainted with the trade: this Appendix is principally introduced for that purpose.

Previously, however, to entering upon this subject, it may be necessary to state, that the first mashing temperatures in the brewery and distillery materially differ. In the brewery, according to law, malt alone must be used; in the distillery no such restriction is imposed. A certain portion of malt is absolutely necessary, that the starch of the unmalted corn may be converted by the diastase of the malt into saccharine matter. The French chemists say, that one portion of diastase will convert 2000 of starch into saccharine matter: be this as it may, we know that distillers cannot succeed in making an extract, without a certain portion of malt in the admixture of the different corns they employ in their manufacture, or the grists, as they are technically called.

Although, however, much lower temperatures must be used in the distillery in the first instance, to avoid setting or coagulation, still the temperature must be gradually raised, until the point of saccharification is arrived at; and the temperature of the taps will consequently be found to be nearly the same.

In the following processes, it must always be remembered, that the great desideratum is, in the first place, to avoid all unnecessary delay in any part of the operation; in the second place, never to let any part of the same tap or wort remain in the underback or elsewhere, while the other part of it is being boiled; and lastly, to make as good an extract as circumstances will permit to be made with safety.

It will be seen, that although we invariably commence with as stiff a mash as possible, the quantity is generally made up during the mashing, to three barrels per quarter. The gradual increase of temperature insures the certainty of arriving at the proper point of saccharification without any risk of coagulation. The change of colour in the extract, and afterwards the white froth on the top of the mash, is an indication which cannot be mistaken, that the extract is then thoroughly made, and all further keeping up of temperature totally useless. This being the case, no other process could do more, and thus all pretended secrecy and mystery generally observed as to the proper mashing temperatures, are now fully disclosed and explained.

By thus commencing the process, we get about two-thirds of the whole extract of the malt in the first tap or wort, instead of only about one-half, when only two barrels of liquor per quarter are turned on; and the worts will be found fully strong enough, with proper management, for producing ale of almost any gravity which may be wanted.

If, therefore, we get in the first mash two-thirds of the extract, instead of only one-half, as by the other process, we must thus greatly facilitate our after proceedings, which is the great point aimed at. As we have now only left in the grains little more than one-third in place of one-half of the extract, the portion left being also of less gravity per barrel than it would otherwise have been, is therefore the more easily obtained in the after mashings. It must accordingly, we think, appear that by the mode of proceeding above recommended, we take the most safe and effectual means of procuring the best extracts.

If the extract be thoroughly made in the first mashing, the after temperatures of liquor are but of little consequence, at least if not taken too high; say not above 190°. By so doing, we run no risk of extracting from the malt those ingredients which could not improve the beer; for the after temperatures, therefore, we refer to the formulæ, and shall now proceed to the first, or what is called a party-gyle, where two sorts of beer are produced from the same brewing.

PARTY-GYLE.

In this case there were three coppers, affording ample accommodation for any manner of working.

1st, or liquor copper, containing 120 barrels.

2nd, or wort copper, containing 140 barrels.

3rd, or little copper, containing 27 barrels.

Here the malt was all ground into sacks, and could of course be turned into the mash tun at any time. Let it then be placed conveniently for throwing it into the tun, sack by sack, as soon as the mashing machine has been put in motion as afterwards described. Let the first copper, either the previous evening, or very early in the morning you intend brewing, be charged with about 100 barrels of liquor; bring this to boil, and let it boil for some little time, to soften the water, by depositing the carbonate of lime contained in it: bring it then down with cold liquor to the temperature of 180°. As a good many degrees in temperature are lost in running the liquor from the copper into the mash-tun, it is necessary to keep it higher in the copper, so as to prevent the possibility of its being too low in the mash-tun. We begin the process at 7 o'clock, morning, with 30 quarters pretty good pale malt, weighing 41¼ lbs. per bushel. Morning 7 — Turn from the copper into the mash-tun 52½ barrels of liquor, being one barrel and three firkins for every quarter of malt. If the liquor be above 168° in the mash-tun, stir it about until it comes to that temperature ; you may at the same time set the mashing machine in motion, which tends to make the temperature uniform. When the liquor in the tun arrives at the proper heat, 168°, stop the mashing machine, and begin to turn your malt from the sacks into the tun. It is necessary in doing so to have three or four men with rakes or shovels, to mix the malt thoroughly with the liquor, as it is thrown into the tun. If the mash becomes too stiff to manage with the rakes, set the machine again in motion, and you may, if necessary, turn on a little more liquor.

The copper should in the mean time be allowed to be gaining a little in temperature, while the mashing is still going on. When the first infusion is well mixed, and the liquor in the copper has attained a temperature of from 185° to 190°, the copper should still be rising in heat, but not above 195°; turn on again from the copper from under the false bottom in the mash-tun, letting the liquor run very gently so as to gradually raise the temperature of the tun, at the same time making the mashing machine move as briskly as possible. The appearance of the extract, when you commence turning on in this way, will be a milky white; as the infusion goes on, it will soon become more transparent, and when looked down upon will have the same appearance as beer when looked at in the same way: you may now let the liquor run more rapidly, and in a short time the top of the mash will be covered with a fine thick froth. We thus know, as before stated, that the extract is thoroughly made, and when thus made, all further keeping up of temperature is totally useless, and may by condensing the steam be injurious; but as this is to be a party-gyle, we do not take so much liquor in the first mash as we would otherwise do. Say, therefore, let the water still run until you have 75 barrels, or two and a half barrels per quarter, after which mash about ten minutes longer. Then cover up the tun and let it stand one hour, which is quite sufficient. The liquor copper, in the mean time, should be again charged up with liquor, and brought to the proper temperature for going on with the after mashings. The mash having stood its time, let the worts now run from the mash-tun into the under-back. The average heat of the tap should be 148° to 152°; they should drain off in about 45 minutes, and there should be from 45 to 47 barrels at 35 or 36 lbs. gravity, per Long's instrument.

Get 23 barrels of this first tap into the little copper for ale to be made 42 lbs. per barrel, and immediately afterwards get the remaining 24 barrels into the large wort-copper, at the same time throwing in a few hops. On trying a sample of the worts, we find they weigh 36 lbs. gravity.

If you multiply, therefore, 36, the lbs. gravity per barrel, by 23, the number of barrels in the copper, it will give 828. This, however, is the aggregate gravity as calculated when reduced to a temperature of 60°, without making any allowance for evaporation and condensation. The late Mr. Richardson, of Hull, has given accurate calculations for the necessary deductions to be made; but as we find that by deducting 10 per cent. we come near enough the truth for practice, and have also less trouble, this mode, which also makes allowance for the quantity retained by the hops, has been adopted.

Having therefore a fallacious gravity of	828
Deduct 10 per cent. . .	85
Real gravity to go into gyle-tun	743

As we intend to make the beer 42 lbs. gravity per barrel, we must now find out what number of barrels of 42 lbs. can be produced from 743; divide, therefore, by 42 the required strength, which will leave 17 barrels and three firkins. Having thus ascertained that we shall have about 18 barrels of ale, now throw the necessary quantity of hops into the copper, calculating by so many lbs. per barrel: this may be 4, 5 or 6 lbs. per barrel, or even more, according to the public taste, and the length of time the beer is intended to be kept. For beer of this gravity, however, there should never be less than from 4 to 5 lbs. per barrel: we shall here take 4½ lbs., which will be 81 lbs.

We have next to calculate what number of barrels must be turned out of the copper so as to have about 18 barrels in the gyle-tun. There are now in the copper, with the addition of the hops, about 24½ barrels. The hops will retain nearly one barrel and a-half, and rather more than two barrels will be evaporated on the coolers, in all 3½ barrels; add, therefore, 3½ to 18, which makes 21½. Three barrels, therefore, must be evaporated in boiling, leaving 21½ to be turned into the coolers.

We must now return to the brewing which we left, the remainder of the first worts being then pumping into the larger wort copper. The water in the liquor copper having now got up to 185°, let run *over* the malt, not under as in the first mash, 1¼ barrels per quarter or 37½ barrels. This may be done by means of a shute and canvas hose. Turn on gently at first, so as to make the liquor find its way through the grains: a deal board should also be placed on the top of the grains or malt where the liquor is running, to prevent its making a hole in the malt, so as to raise without penetrating it. If the malt be of good quality, the grains will in the course of 10 or 15 minutes rise through the water; and as soon as this happens, the extract may be let run into the underback pretty smartly, so as to drain off in half an hour. If the grains do not rise, they must be roused with the mashing-machine. This second mash should be pumped as speedily as possible into the large wort copper among the 24 barrels of first worts already there. Get on the fire now as briskly as possible. Lose no time in proceeding with the third mash, and for that purpose turn over the grains as before directed, 15½ barrels at 160°. This may also be let run as soon as it has disappeared through the goods in the mash-tun, and be pumped, as before directed, into the copper. The whole of this process should not occupy more than five hours. As soon as the mash-tun is drained off, turn on 70 barrels for raw or return wort for next brewing, at any temperature from 140° to 170°, the mode of treating which will be afterwards explained. We now dip the wort copper, and find that we have by gauge 77½ barrels of wort: rouse it thoroughly, so as to mix completely the different taps; having then taken a sample, we find the average gravity to be 22·5 lbs. per barrel when taken at a temperature of 60°. Multiply, therefore, the number of barrels 77·5 by 22·5, the product will be 1743·7, from which deduct 10 per cent., say 174 — the remainder will be 1569·7. The desired strength of the beer to be produced is 26 lbs. per barrel — divide, therefore, 1569·7 by 26, which gives 60 barrels and 9·7. Throw now into the copper 120 lbs. of hops, being two pounds per barrel. How many barrels must be turned out of the copper to leave 60 in the gyle-tun? Two barrels will be retained by the hops, and 10 per cent. will be evaporated in cooling or 7 barrels; add, therefore, 9 to 60, making 69: the boiling must, therefore, be continued until only 69 barrels are left in the copper.

We now return to the raw wort: 70 barrels had been turned over; let the mashing-machine go round the tun a few turns, then let the worts run, and pump them into the first or liquor copper as soon as possible — 73 barrels. Bring them to boil. Their gravity may be 2 lbs. per barrel, or 146 lbs.:

add the hops of the other boilings when the worts are drained off; you will gain from the hops of the best ale about 56 lbs., being the strength of one barrel and one-third retained by them, and from the second 52 lbs., the strength of 2 barrels retained by them. Bring the whole again to boil. Before being used, they must be run through the hop-back into the under-back, and again pumped into the copper, where we shall now find perhaps only 65 barrels at 4·5 gravity—292·5.

To old brewers, or those well acquainted with the trade, the above details may appear too minute and prolix; but as this Appendix, as already stated, is principally intended for beginners, we have thought it necessary to be thus minute for their instruction. We shall now proceed to the fermentation of the two qualities of the beer, beginning with the stronger.

Fermentation of the Best Ale.

Monday evening, 3 o'clock. — The wort in the cooler having now got to a temperature of 70°, weigh 5 lbs. of fine lively stillion yeast, which mix in a pail or bucket with a gallon of the worts; as soon as this mixture begins to work up or rise in the pail, let two barrels of the worts run into the fermenting tun, into which throw the yeast from the pail, stirring it about so as to thoroughly mix. This is called pitching. When the remainder of the worts in the cooler get to a temperature of 60°, weigh out 75 lbs. more of the same yeast, which mix up with worts in a stand, so as to be rising, as before mentioned. We now want to have all the worts in the gyle-tun, which, when mixed, shall be at a temperature of 52°. No specific directions can be given for this purpose, as in some brewhouses the worts lose more heat in a short time than in others, and also in running from the coolers to the gyle-tun: a little practice, however, will enable any one to judge for himself, according to circumstances.

As the worts continue running down, take a sample for weighing, and go on adding a little more yeast from the stand, until the whole has been used.

When the worts are all down, gauge them with the dipping rod, and after rousing well to mix the yeast, cover and close the tun.

We find by gauge that we have 18 barrels, weighing 42 lbs. per barrel.

Tuesday morning, 6 o'clock. — Rising with a fine healthy curl — heat 53½°. Evening, 6. — Rising to a fine rocky, light yeasty head, the stomach or aroma smelling quite sound and healthy: heat 57°.

Wednesday morning, 6 o'clock. — All right, the light yeasty head having dropped during the night, was now rising to a fine close yeasty head with numerous little bright air-bells breaking and puffing out gas; heat 65°, attenuated to 29½ lbs. Evening, 1.—Still rising vigorously, and all right; heat 70°; add 5 lbs. of yeast treated as before. Evening, 11.—A fine close yeasty head as before described; the stomach sound, pungent, and highly aromatic: heat 75°, attenuated to 19 lbs. cleansed.

Fill up the casks every hour with the beer thrown out from the casks into the stillions, for the first eight hours, by which time it will have got pretty steady; it may afterwards be filled up occasionally for two days more. In throwing off the yeast, it will be found that the beer has attenuated 5 lbs. more, being now at 14, or one-third its original gravity, which is quite right. For further directions, see *Storing and Keeping Beer.*

Fermentation of Second Ale.

Monday evening.—On proceeding as directed for the Best Ale, we find we have 60 barrels at 26·2 per barrel. When the worts get down to a temperature of 75°, pitch as before directed, with 10 lbs. of yeast, and 3 barrels of worts; get all into the gyle-tun at a temperature of 58°, adding 140 lbs. more of yeast treated as directed in the process.

Tuesday, 6 A. M.—Just beginning to curl; no heat gained. 6 P. M.—Rising to a fine rocky head, stomach sound and healthy; heat 66°.

Wednesday, 6 A. M.—The light yeasty head just beginning to drop, heat 66°, attenuated to 18 lbs.; added 6 lbs. of yeast rising in the pail. 11 A. M.—Rising to a fine close yeasty head and all right. 3 P. M.—All right, heat 72°, attenuated to 12 lbs. cleansed; fill up as before directed, and when done working in the casks, the ale will be down to 9 lbs. gravity.

In all healthy sound fermentations, allowance must be made when cleansing for the additional attenuation in the cleansing casks.

We must now calculate what number of lbs. gravity we have obtained per quarter from the malt.

18 barrels in best ale at 42° make 756
60 do. in 2nd ale at 26·2 do. 1572
65 do. in raw wort at 4·5 do. 292·5

Divide by number of qrs. used 30)2620·5(87·3
per quarter, leaving out fractions.

The rule for the quantities to be turned out of the copper, so as to produce the required number of barrels in the gyle-tun, as described in the foregoing process, if the copper be truly and rightly gauged, will always approximate nearly enough to the truth for practice, making allowance for the difference of evaporation on the coolers, according to the state of the atmosphere. If more than the usual evaporation takes place, the quantity will be less, but the worts will be proportionally stronger, and vice versâ.

We often, however, find coppers so inaccurately gauged as to make a difference of 4 or 5 barrels or more. In following this rule, therefore, it is indispensably necessary that the copper should be accurately gauged. The simplest and best mode of doing so is to fill the copper brim full with water, and having found a cask which contains precisely 36 gallons, or a barrel of liquid, take out one of the ends of it; you must then procure an unmarked wooden rod, long enough to reach the bottom of the copper; a piece of board must then be placed on the top of the copper, stretching out so as to conduct the rod perpendicularly to the bottom. Great mistakes are often made by not attending to this rule. The copper must then be run off barrel by barrel, very accurately, and at every barrel the rod should be dipped to the bottom of the copper, and a notch made where the water cuts the rod, barrel by barrel. This gives an accurate dipping-rod for the wet dip, and by reversing it and placing a piece of cork as usual on the other end, we have a dry dipping-rod.

In small coppers for private brewings, the same rule may be adopted, by marking the rod at every 1, 2, 3, or 5 gallons, as circumstances may require.

FURTHER REMARKS ON BOILING.

Before proceeding with the directions for the next brewing, in which there are two boilings of the worts with only one copper, it may be necessary to give some information respecting the most eligible mode under these circumstances of boiling.

The practice of extensive brewers, during the last century, was to have generally three boilings of the worts in every brewing. The first was called the hop-wort; the second the jack-wort, and the third, the blue-wort. At that time, what are now termed raw or return worts, were but little known, and of course, seldom employed. It was therefore necessary, they considered, to have three boilings, in order to get the best possible extract from the malt; and perhaps they were right. Now, however, when the mode of making extracts *begins* to be much better understood, three boilings in the same brewing are seldom resorted to, excepting by those who obstinately adhere to the old practice, which has no other claim to adoption than its antiquity.

It has been already stated, that all delay in the process of brewing should as far as possible be avoided. Three boilings must necessarily occupy more time than two, and two boilings more time than one; if therefore the position be allowed (of which there can be no doubt), that all delays are dangerous in the process of brewing, one boiling is safer than two, and two safer than three.

No particular objection can be made to two boilings at any time, where that may be found necessary: as we shall be able to show that by proper management, and even with only one copper, the process may be so conducted, that none of the taps need lie any length of time either in the underback or elsewhere, before being conducted to the copper. One boiling, however, is always the safest in summer brewing.

Let the brewings be made of shorter lengths, and the more frequent the better, so as that the yeast may be always preserved in good order.

With only one copper, three boilings must invariably produce unsoundness to a certain extent, in hot weather.

We have, however, encountered individuals so confident in error, as to insist that they must and would brew the same quantities of malt which they had been accustomed to do, and that with only one copper totally inadequate for the purpose; by which mode of proceeding they invariably produced very unsound beer.

With smaller brewings of only half the quantity of malt, the worts were boiled in one operation, and the beer turned out well; and the trade did not require more than two of these smaller brewings per week. See *Summer Brewing.*

ONE COPPER TWO BOILINGS.

A Brewing with only one Copper, containing twenty-five Barrels where two Boilings are necessary.

THE great desideratum, in this case, is to get on with the process with the least possible delay, and to let no part of the worts remain longer than is absolutely necessary, between the mash-tun and the copper. As beer of from 24 to 27 lbs. gravity per barrel is now very generally wanted, we shall take here 24 lbs. for our standard, having no mashing-machine.

The copper having been previously brought to boil, the water should now be cooled to a temperature of 180°, by adding what may be necessary of cold water for that purpose. Eight quarters of tolerably good malt standing in sacks near the mash-tun, weight 40 lbs. per bushel.

Commence brewing at seven o'clock in the morning. Let run into mash-tun 14 barrels at 180°; stir it about until it gets down to 170°; then turn your malt into the tun, sack by sack, thoroughly mixing it with oars and rakes, as you proceed. If the mash should become too stiff for working, run one barrel or two barrels, if found necessary, from under the false bottom of your mash-tun into the mash; this will enable you to infuse all your malt. Now get on your fire until the water in the copper reaches 185°, when you may damp the fire so as to be acquiring a little more heat; it is necessary, during this time, to be going on mashing, and for some one to break with a stick, or any other instrument which may be applicable for the purpose, all the lumps or knots of uninfused malt, as they are brought up to the surface. Now turn on from the copper, still from under the false bottom, letting the water run very gently, (and still mashing, now as vigorously as possible, so as to diffuse the heat more regularly,) until the milky white appearance of the extract has disappeared, and been succeeded by greater transparency, when you may let the water run more quickly. In a short time the mash will be covered with a white froth ; the extract is now thoroughly made. Let your liquor run, and keep mashing until you have turned over, in all, twenty-four barrels, or three barrels per quarter, when, after mashing about ten minutes longer, at the same time going round the bottom of the mash-tun with your oars, you may cover up the mash. Since writing the above in the first edition, it has been found that covering up the mash so as to prevent the escape of steam is injurious, as can be easily proved. All this should occupy a space of not more than three quarters of an hour. Let the mash stand an hour and a-half or less, then let the worts run, not over quickly, into the underback. You should, in the mean time, have your copper charged with liquor for next mash; and should any boiling liquor be wanted for scalding your utensils, &c., now is the time to procure it. When the mash-tun has been quite drained off, take for your second mash only the necessary quantity of liquor to make up your first boiling. You should have in the under-back not more than sixteen or seventeen barrels, your malt not having been of first-rate quality. Let four barrels, therefore, run gently over the top of the malt, sprinkling it all over, either from a canvas hose or a sparging-machine, if you have got one. As soon as the liquor disappears through the grains, which will be very shortly, let it run into the under-back, making twenty-one barrels for first boiling. Go on now as quickly as possible with your third mash; let twelve barrels, at any temperature not exceeding 170°, or below 150°, run over the goods, as before directed, and "immediately get your first worts into the copper, at the same time carrying on the fire as briskly as possible, add 52 lbs. of hops, or two lbs per barrel for the quantity of beer to be produced." We return again to the mash-tun. If the water has all disappeared, and the grains are floating on the surface, no mashing is necessary; if not, they must be again roused by mashing. Let this mash stand until your first worts begin to boil, then let them run gently, so as to keep pace nearly with your boiling; when drained off, take cold liquor to make up your second worts, and to wash out any little saccharine matter remaining in the grains.

In this case, sprinkle four barrels over the grains, and let it run briskly as soon as it disappears through the grains. The first worts, having now boiled one hour and fifteen minutes, may be discharged or turned out, as it is termed, from the copper for cooling. Get your second worts up as soon as possible, rouse them well, and take a sample for weighing; add the hops from first worts when drained. In the first worts we had twenty-one barrels in the copper, at 26 lbs., when reduced to a temperature of 60°.

Multiply 26 lbs. by 21bls., making	546
Deduct 10 per cent.	55
Leaving, of real gravity in gyle-tun	491

After boiling, and the loss in quantity by evaporation and condensation on the coolers, we find that we should have in the gyle-tun 16 barrels at 31 lbs. gravity, or 496.

On gauging the second worts in the copper, we find 17 barrels of 8 lbs. gravity, at 60°.

Multiply 17 by 8, making	136
Deduct, as before, 10 per cent. ..	14
	122
Add 28 lbs. from hops of 1st worts	28
Add gravity of first worts	496

Br. Fir.
Div. by required grav. pr. bl. 24)646(26 3
leaving out fractional parts.

We have sixteen barrels of first worts, and therefore require ten barrels and three firkins of second worts to make up the required quantity—what number of barrels should be turned out of copper ?

	Bs.	F.	G.
Wanted 10¾	10	3	0
Add retained by hops	0	3	4
Evaporation, &c. on coolers .	1	1	0
	12	3	4

You must therefore turn out of the copper, in round numbers, thirteen barrels by gauge.

We find, in the fermenting tun, 26·5 barrels at 24·2, making 641·3 lbs. of gravity: the previously calculated gravity being 646, not one per cent. difference.

This is quite near enough for practice. It will be seen, that in the above process of making the extract, none of the worts can possibly get tainted from lying too long in the underback, or elsewhere, and this mode of procedure is calculated to make the best possible extract from the malt which circumstances will permit. If all is right, the fermentation will go on regularly, as before described; if it does not, the cause of failure must be traced and removed.

To find the gravity per quarter, divide 641·3 by 8, the number of quarters used: 8÷641·3=80·1, omitting fractions.

ONE COPPER ONE BOILING.

A Brewing of ten quarters, with mashing machine, with only one copper, large enough, however, to contain all the worts in one boiling, or fifty barrels.

Ten quarters of good malt, with a shade of colour, weighing 42 lbs. per bushel. The copper having been brought to boil, and allowed to boil for some time, should be nearly full, leaving room only for cooling down, with cold liquor, to a proper temperature. If the malt hopper be so constructed as to run the malt into the mash-tun at any time, it is better to run the first liquor into the tun previously to the malt being put into the mash-tun, allowing it to come down to its proper temperature in the tun; the malt may then be run into the tun gradually, while the mashing is going on. The malt in this instance had been previously placed in the tun.

Ale of twenty-six pounds' Gravity.

7 A.M.—Turn on eighteen barrels, at 169°, allowing the copper to be gaining in heat at the same time: mash until the malt is all thoroughly mixed with the liquor, fifteen minutes or more, if necessary. Liquor in copper now at 185°; turn on

gently from under false bottom; this is certainly better than sparging or sprinkling, at all events, in this stage of the process, as the heat, by rising gradually from the bottom, will be more equally distributed than when sprinkled on from above; at the same time go on mashing, the machine must be going round as quickly as possible. As we have in this instance a large quantity to use, the liquor in the copper should not be allowed at any time to exceed 185° or 186°, so as to bring the heat of the taps to the proper medium, viz., 148° to 152°. As soon as the milky white colour of the extract has disappeared, and been succeeded by greater transparency, let the liquor run on more quickly; in a short time the mashing will be covered with the white froth; keep on mashing until you have turned on in all thirty barrels of liquor, or three barrels per quarter; when, after a couple of rounds of the machine, you may leave off. Let the tap stand one hour and a half; then let the worts run from the mash-tun into the underback; this should be about half-past nine: when drained off, we find in the underback twenty-two barrels, at 30 lbs. gravity.

If warm water be wanted for scalding the utensils, or other purposes, the interval occupied by the standing and running of the first mash, is the proper time for preparing it, taking care, however, to leave enough in the copper, at the proper temperature, for the brewing, so as not, in any way, to delay the process.

10 A.M. — Now let run over the malt in the mash-tun, not from under the false bottom as done in the first mash, fifteen barrels of liquor, at a temperature of 185°. As soon as the goods have risen, let the worts run into the underback, upon the first tap. It sometimes happens with inferior malt, or too low grinding, that the grains will not rise, in which case they must be roused by the mashing machine. The second mash produces fifteen barrels and a-half, at 18 lbs.; and as the temperature is considerably higher than the first worts, it also raises their temperature, which tends to prevent their getting tainted; a few handfuls of hops should be sprinkled over them in the underback. There should now be left in the copper only the quantity to be used for next mash, say eight barrels, at any temperature below 165°. Now (11 o'clock) turn these eight barrels over the goods as before, and immediately pump the worts from the underback into the copper; let the eight barrels run as before directed, and pump them into the copper as they run from the mash-tun into the underback. Now, as there is no raw wort, run two or three barrels of cold liquor over the goods or grains in the mash-tun, to wash out any little saccharine which may remain.

When we have got all in copper, we find—

Forty-seven barrels at 22·3—or . .	1048·1
From which deduct 10 per cent. . .	109·1
Divide by 26, strength required per barrel	26)939·0(36 and 3 lbs. over.

We must now, as before, calculate what number of barrels must be turned out of the copper, so as that 36 may go into the gyle-tun. We use 2 lbs. of hops per barrel, 94 lbs., which will increase the quantity in the copper to 48½ barrels, and these will retain one barrel and a-half, or rather more, and about eight barrels will be evaporated on the coolers.

Wanted	36
Add for evaporation and condensation .	8
Retained by hops	1½
Turn therefore out of copper . . .	45½ brls.

We find, in the gyle-tun, thirty-six barrels one firkin, at 26 lbs. gravity, or nearly so, at least correct enough for practice.

Multiply the number of barrels in tun .	36
By the gravity	26·2
Div. by the number of quarters malt	10)943·2(94·3 gravity per quarter.

For process of fermentation, see page 184., "Second Ale."

PLAIN DIRECTIONS TO PRIVATE FAMILIES FOR BREWING THEIR OWN BEER.

For a Brewing of Eight Bushels.

In private or family brewing it is quite as necessary to adhere to the general rules laid down in the foregoing pages as it is in a large establishment. Families commonly brew only twice a year, in October and March. It has been already stated, that malt which has been kept over the summer, is liable to get slack or moist from exposure to the atmosphere, and that such malt will almost invariably produce unsound beer. Private families, therefore, cannot be too careful in selecting their malt for October brewing. If they must brew with malt of the above description, they should insist, that before delivery, it should be again dried upon the kiln, so as to expel the moisture, even although it should cost them two shillings per quarter more; or, they may delay their brewing until good new malt can be procured. The March brewings are frequently better than those in October, from the above-mentioned precaution not being attended to. The brewing vessels also are liable to get tainted from being long out of use, it would therefore be advisable to scald them out before brewing, with hot water and a little chloride of lime (bleaching powder). By adhering strictly to the following directions, they will run less risk of their worts being tainted than when more time is occupied in the process.

The day previous to the commencement of brewing, examine all the utensils very carefully, and be sure that they have been thoroughly scalded and scrubbed. On the morning of the day on which you intend to brew, having nearly filled your boiler with water, make the water boil, and continue the boiling for some time. This may be done the day previously; the object being to soften the water, particularly when its principal impurity is owing to carbonate of lime. If the water is hard, or containing sulphate of lime, which curdles soap even when boiled, an alkali, such as sub-carbonate of potash, (salt of tartar,) or subcarbonate of soda, may be thrown into the water, in the proportion of not more than one ounce to a barrel or thirty-six gallons: this will sufficiently soften such water.

Morning, 7 o'clock.—The water in the boiler being now at a temperature of 180° F., let run into your mash-tun one barrel and a-half, or about 7 gallons of water to each bushel of malt: stir this about until it acquires a temperature of 170°, then commence the gradual addition of your malt; taking care to mix it thoroughly with the water by means of oars and rakes, as it goes into the tun. When the mash is too thick for stirring, add a little more water, letting it run slowly, say half a barrel, or about two gallons per bushel, at a temperature of 180°; this will enable you to infuse the remainder of your malt. Let your copper in the meantime be gaining heat until it reaches 190°; then damp your fire. If you have the means of doing so, let your liquor at 190° run very gently from under the false bottom of your mash-tun. If you cannot let it run from below, it must be sprinkled over the top of the mash, by means of a watering-pot such as is used by gardeners for watering plants. You should in the meantime continue mashing as quickly as possible.

As soon as the milky whiteness of the extract disappears and is succeeded by greater transparency, let the water run or be sprinkled on more quickly, when in a short time the white froth will make its appearance all over the tun. Your extract is now thoroughly made. If your malt be of the best quality, you may take in this way for your first mash, in all, three barrels of water per quarter, or 13½ gallons per bushel.

Having now done mashing, sprinkle a little dry ground malt over the top of the mash, and cover up the tun. Let it so stand for one hour and a-half; then set tap, as it is technically called, or, in other words, let your worts run from the mash-tun to the underback.

The boiler should in the meantime be again nearly filled with liquor, and brought as speedily as possible to a temperature of 185°.

When the mash-tun is quite drained off, proceed immediately with your second mash, the liquor in your boiler being now at 185°, which is the best temperature, but do not delay your process for the difference of a few degrees. Turn on, *over*, not *under*, the malt, very gently at first, so as to let the liquor find its way down through the malt as you proceed, one barrel and a-half per quarter, or nearly 7 gallons to a bushel. Should any remain in the boiler, let it run to waste, or retain it for some other purpose. Lose no time now in pumping or getting your first tap or worts into the boiler, where you should find rather more than 2 barrels at 30 lbs. gravity per Long's instrument: to this add 9 lbs. of hops or 6 lbs. per barrel (for the ale to be produced) or more, if highly-hopped beer is wanted. Get your copper to boil as soon as possible, and keep it boiling for an hour and fifteen minutes, then turn your worts out through the hop-back into the coolers.

We now return to the second mash in the mash-tun. Should the malt have risen up through the liquor on the top, no farther mashing will be necessary; but if it does not rise, it must be stirred up by oars or rakes. Let this mash stand until your first worts begin to boil; then let it run gently, so as to keep pace nearly with your boiling. As soon as this is drained, sprinkle over the malt, with your watering-can, about half a barrel of cold water, or a little more than two gallons per bushel; let this run as soon as it disappears through the grains. When your copper is discharged of the first worts, get your second into it as speedily as possible, and keep on boiling; add the hops from the first worts as soon as they are drained. Boil this second wort from one hour and a-half to two hours, at your own option. That long boiling acts as a preservative to the beer, in any other way than increasing the strength by evaporation, is quite a mistake.

The above process is given on the supposition that your brewing utensils are large enough for the purpose. If they be not, it is better to brew a smaller quantity of malt, which will then enable you to proceed as above directed. The reasons for this alteration are obvious: none of your worts with the diminished quantity are allowed to remain any length of time between the mash-tun and the copper; an arrangement which prevents their getting tainted, as is too often the case, when otherwise treated; necessarily destroying the whole of the beer.

We shall now proceed to the fermentation, beginning, of course, with the first worts or strong ale.

We found in the copper rather more than two barrels at 30 lbs. gravity: this quantity, by the waste in boiling and by the evaporation and condensation in the coolers, will now be reduced in the fermenting tun to about one barrel and a half, or a hogshead. As no saccharine matter, however, is lost by evaporation, either in boiling or cooling, the *strength* or gravity will now be rather above 40 lbs. per Long, or 1·112 specific gravity, by Allan's or Bates' instruments, (described at p. 57.,) which is quite strong enough for any kind of ale.

It is difficult to say what is the proper temperature at which to commence fermentation on a scale so small. If, however, an uniform temperature of 55° to 60° can be preserved in the tun-room, it will be desirable, as ale of this strength should never be placed in the tun at a higher temperature than 54° or 55°; but if from the situation of your brewhouse it be subjected to all the different fluctuations of the atmosphere, particularly in winter, the worts, if got together at so low a temperature, may, perhaps, lose as much as 5 or 6 degrees before fermentation can begin: in this case fermentation will hardly commence at all, or if it does, will go on so sluggishly as to prevent the possibility of ultimately arriving at the proper attenuation, unless the temperature be raised as directed, p. 129. This, therefore is a point upon which no definite or certain directions can be given; and the operator must of necessity be left to his own judgment.

The great rule by which we ought to be governed, is—never at any period of the fermentation to admit such high temperatures as to be carrying on what is called the *acetous* instead of the *vinous* fermentation. It is still disputed, and must always remain a delicate question among chemists, at what temperature the *acetous* fermentation commences; but at or under 75°, or, perhaps, even a few degrees higher, little or no risk can be run; it is, therefore, desirable to keep within the limit of 75°. In all cases of this kind, therefore, the proper temperature at which the worts must be got together in the fermenting tun, must depend on such circumstances as can only be judged of by the brewer.

Let us suppose that the worts, when placed in the fermenting tun, are at a medium temperature, or at 58°: thus leaving opportunity for an increase in temperature of 18 or 19 degrees before cleansing or tunning. Let a sufficient quantity of good, sound, lively yeast, be procured, and when the worts in the coolers fall to a temperature of 70°, mix two pounds of the said yeast with a little of the worts at that temperature, contained in a pail. As soon as the mixture begins to rise, let 10 gallons of the worts run into your fermenting tun, into which throw your yeast so rising. This is called pitching. Rouse it about until it is thoroughly mixed; then take six pounds more of the same yeast, and mix it with worts in a pail as before-directed, so as to let it begin to rise in the pail before using. If it begin to flow over the pail before the worts have arrived at the proper temperature of 62° or 63°, pour a little of it into the fermenting tun. When you begin to let your worts run so as to have your mean temperature at 62°, throw in the remainder of the yeast: and when the worts are all collected, stir the whole again until it is thoroughly mixed. It is requisite on this small scale to cover the tun so as to retain the heat.

If your worts be sound, and your yeast also sound and lively, the fermentation should now go on as described at page 183., under the head of "Best Ale Fermentation;" and your ale should be ready for tunning on the third morning after brewing. Should the weather be cold, scald your cleansing casks with a little boiling water, just before cleansing; this will prevent your beer being chilled, which would retard its working. Fill up the casks, from the beer thrown off, every hour for the first eight hours, after which draw off what beer may still remain in your stillions; which, if put into an open-headed, broad vessel, will soon get pretty clear. Fill up the casks occasionally with this beer for two days more, and for all further directions refer to page 141., on "Storing and Keeping Beer."

We shall now proceed with the fermentation of the *second worts*. We had in the copper rather more than two barrels, at a gravity of 13½ lbs., which when boiled and cooled down like the others, will also leave a hogshead of beer to go into the fermenting tun. This beer will now be of 18 lbs. gravity per barrel, by Long's instrument; or 1·050 specific gravity, by Allan's.

When at a temperature of 75°, pitch as before directed, with 10 gallons of worts and 2 lbs. of yeast; get all into the tun at a temperature of about 68°, adding 2 lbs. more yeast, treated as before directed. Cover up the tun, and cleanse the beer, at the third change, or when it has risen to a light yeasty head; proceeding to fill up, as before directed for the ale; and look at "Storing and Keeping," for further directions. We trust we have now given such explicit and ample directions for brewing on a small scale, as will enable any private family to brew even the small quantity of one bushel, with certainty. It must be observed, however, that in very small brewings, the temperature for adding the yeast to the stronger beer must be 6 or 7 degrees higher than in larger brewings.

Should the fermentation at any time get too cold, proceed as directed, p. 129.

The quantities of water to be used in the above brewings, are stated both in barrels per qr., and gallons per bushel of malt; if, therefore, two or more qrs. are to be used, take your quantities of liquor by barrels per qr.; if smaller quantities, such as two, three, or four bushels, take your quantities of liquor by gallons per bushel, as above directed.

SACCHAROMETER.

All Saccharometers now in use are graduated to a scale of barrels containing 36 imperial gallons each. If gravities, therefore, be reckoned by barrels containing only 32 gallons, the calculations must be very erroneous. An Irish barrel contains only 32 gallons, and yet many brewers in Ireland, in calculating the gravities obtained from the malt, multiply by their own barrels, and thus persuade themselves that they are getting much greater lengths than the malt could possibly produce. Thus, suppose brewing 30 qrs. of malt, they have 100 Irish barrels in the gyle-tun at 30 lbs. gravity per Long's instrument (which is equal to 83·4 by Bate's), they reckon they have 3,000 lbs., or 100 lbs. per qr. Instead of this, however, they have 400 gallons less than 100 barrels, leaving only within a fraction of 89 imperial barrels; they ought, therefore, to multiply 89 by 30, which would make only 2,670, instead of 3,000 lbs. Divide, therefore, 2,670 by 30, which will give the true gravity per qr., or 89 lbs., instead of 100 per Long's instrument (or 247·4 by Allan's or Bates').

Saccharometers which have been long in use will, from the friction used in cleaning them, become lighter, and consequently show considerably higher gravities than those actually produced. This is a point seldom thought of. They should, therefore, be occasionally tried by dipping them in the water used for brewing, at a temperature of 60°, when, if the water do not cut the stem of the instrument at the proper point indicated as the water line, the instrument should be adjusted. Many Irish brewers, by calculating in the above-mentioned erroneous manner, are led to believe that their practice must be far superior to that pursued in the Sister Island, or that their malt must be of better quality. Neither of which, however, is the case.

DIASTASE.

Little more has been elicited of the nature and powerful action of Diastase in the mash-tun, since our first publication. The minute directions given as to the first mashing temperatures, are calculated to secure as perfect and sound an extract, as the action of Diastase can produce. If, therefore, the indications before mentioned be shown, we may rest satisfied that as good an extract has been made as the malt used can possibly produce, at least in sound wort. If the indications do not take place, it must proceed either from bad manipulation, or the inferiority of the materials used. Having thus endeavoured to put an end to all mystery on this most important subject, we here insert our article on Diastase from the First Edition.

The researches of the French chemists last summer (1834), will shed a new light on the nature and properties of malt, and the mode of extracting. *Starch* is described as consisting of minute particles, like granules, each of them included in a skin or cuticle, a thick, slimy, gum-like body, and therefore resembling somewhat the structure of seeds. To the internal contents of these granules, M. Biot gave the name *dextrin;* it might also be called starch-gum, because in its properties it is quite analogous with the latter. The skinned integument, including the *dextrin*, prevents the starch from coming forth; for starch is not soluble in cold water. But by breaking the cuticle this is accomplished, and gum produced from starch, or rather gum contained in starch, is made free.

For attaining this, the following means are at present known. — 1. *Boiling.* The more such particles are torn by the heat, the more of the gum is dissolved; and the more particles of starch are preserved in the fluid, the more paste-like remains the latter. — 2. *Roasting.* In both cases, the heat partly tears and partly annihilates the cuticles. This case sometimes occurs in kiln-drying. — 3. Treating it with some acid fluid.—4. Treating it with malt, which, in a manner not yet known, by a substance contained in it (*diastase*), has the power of lacerating the cuticles of the starch granules. The *diastase* contained in malt is said to be a solid, white, tasteless, uncrystallised body, soluble in water, but insoluble in alcohol. Dissolved in water, it turns sour very soon. Its most remarkable property is, that one part of it is sufficient to tear, or burst open, 2000 parts of potatoe starch diluted by 8000 parts of water, by which means its dextrin becomes free, and its insoluble cuticles are either precipitated or made to swim on the surface. Diastase is produced by diluting malt-meal, or bruised malt, in cold water, filtering the fluid, and heating it: it becomes turbid, and some substance resembling white of eggs is precipitated: strain again, and add absolute alcohol (free of water), whereby the diastase falls to the bottom, while the sugar which was in the malt remains dissolved. It is then dried by a low heat, because a higher one would decompose it. The heating of the solution is not necessary: or the diastase may be separated by the mere action of alcohol. Diastase, produced in the above manner, is not quite pure, still containing some azotic substance, which may be removed by a repeated digestion of the product by water, and precipitation by alcohol. In seeds, which have undergone germination, it is contained in the immediate neighbourhood of the blade, but not in the rootlets. By the boiling-heat the diastase loses the power of converting starch into gum and sugar: this therefore, is the substance by the action of which saccharification takes place in the mash-tun.

This completely accounts for an almost instantaneous change of colour in the extract, which invariably takes place in the mash-tun during the first mash, when the heats are properly taken.

If, therefore, this change of colour do not take place, we may rest assured that our mashing temperature is wrong.

It also proves what has been already stated in the foregoing pages, that nearly the whole of the extract is made in the first mash, and that all we do afterwards is merely washing out that which remains of the extract in the grains.

It also shows the importance of taking our first mashing temperature properly. By the boiling temperature, say the French chemists, the *diastase* loses the power of converting starch into gum or sugar. Thus *setting the goods* in the tun.

It may be possible that a considerably lower temperature than the boiling may have the same effect of destroying the power of the *diastase;* indeed we know that it does so, as goods have often been set at much lower temperatures than boiling. As already stated, therefore, under the head of Mashing, we should rather turn on the first liquor too low than too high; for too low a temperature may be corrected in the after process, whilst, on the other hand, we now have it distinctly pointed out to us, that too high a temperature is destructive.

This discovery of the French chemists may also lead to other very important results in the formation of extracts; but as it has only been pointed out to me by a friend since writing the foregoing pages, we are neither of us altogether prepared to give the results of any practical observations we have as yet made upon the subject. I know, however, that my friend, already mentioned, Mr. Robert Stein, had, long ago, ideas as to the formation of extract, which this new discovery appears completely to confirm.

There can be no doubt that a peculiar change takes place in barley during the process of its being manufactured into malt, which change is absolutely necessary for the conversion of the starch of the grain into saccharine matter in the mash tun; but what this change really is, or how it is effected, remains still a matter of doubt. It was at first supposed, as stated above, that it was a certain component part of the malt, which, by chemical means, might easily be separated from it, and might *per se* be made available for other purposes. This opinion, however, is now losing ground, and chemists begin to doubt whether diastase as a separate principle really exists; at all events, it is in quantities so small as to be but very rarely seen, and such a substance is now hardly known, nor is it to be obtained at the present time even in Paris, where the discovery is said to have been made. I have been favoured with the following opinion of diastase by a scientific friend who has made some experiments on the subject.

"The gluten of all grain is known to be particularly prone to spoil or undergo decomposition when wet, and this decomposition passes through several stages, ending in complete putrefaction. In these different points of its progress to putrefaction, the gluten of barley and other grains acts as a ferment, but with different results in the early, from what it produces in the late stages. It is only in the first stage of decomposition that gluten saccharizes, and it is in this state in barley which has been moistened and begun to germinate. Yeast is still only the same gluten, but farther decomposed; it is then capable of decomposing saccharine matter, and resolving it into alcohol and carbonic acid, that is of producing the vinous fermentation. Diastase, therefore, is a peculiar condition of the glutinous part of malted grain rather than a distinct principle; the name, however, is still retained in this sense by chemists, as being a convenient term for certain purposes." My friend, Mr. Maugham, also, some years ago, at my suggestion, made some experiments in respect to diastase; and he afterwards stated to me that there is no such thing *as diastase as a distinct principle.*

Of its actual effects in the mash-tun, we know very little more than when it was first discovered, being merely that some peculiar change is effected in barley in the process of malting, without which but very little saccharine extract can be obtained. Corn-distillers also cannot get an extract without a mixture of malt.

We know also that a certain temperature is requisite to be acquired in the mash-tun before the extract can be thoroughly formed, and that going beyond this temperature may do harm, but cannot be of any benefit. When the proper temperature is gained, an almost instantaneous change takes place in the appearance of the mash, so perceptible to any one at all acquainted with the process as fully to point out to him that his object is now attained. He also knows that very little further manipulation on his part is either useful or beneficial — and I can assure him that a few degrees up or down in the temperature of the mash, when running off from the tun (upon which so much is sometimes thought to depend) will be of no material importance. He may be certain that the proper chemical change has taken place for ultimately producing the best beer; let him not then, by a mistaken avarice, in carrying the process too far, run the risk of counteracting, by any addition of that which may be injurious, the proper effects of that extract which has already been so well prepared.

SPONTANEOUS FERMENTATION.

It being a disputed point whether the vinous fermentation would take place, in worts or wash, when the air is excluded, without any addition of yeast or other ferment, we shall here introduce minutes of an experiment, which was made under our notice, and which appears very conclusive. The quantities operated upon were but small, being only two pints of distiller's wash. One pint at a gravity of 75·2 by Bates' instrument, was put into a common wine bottle, which was well corked, and a piece of bladder tied tightly over the cork, so as to exclude all extraneous matter: the gravity of the other pint was 41·5 by the same instrument, and was put into another bottle, and treated precisely as above, no yeast was employed. The two bottles were then suspended in a distiller's wash-back, which had just been pitched at a temperature of 66°, with the usual quantity of yeast.

	No. 1 Bottle.		No. 2 Bottle.		
Date of observation 1839.	Degrees of Temperature.	Gravity.	Degrees of Temperature.	Gravity.	
5, P. M. Jan. 24	52	75·2	54	41·5	Bottles placed in square.
25	68	75·0	66	41·5	Wash-back 71°, no appearance of fermentation in either bottle.
26	70	73·2	70	41·1	Back in which bottles were placed 80°. No. 1 bottle a creamy head. No. 2 a frothy head, and on drawing the cork a hissing noise was heard, fermentation in both pretty strong.
28	66	49·6	68	17·8	No. 2 bottle, the gas, on cutting the string of the bladder over the cork, forced it out violently, and the contents commenced working over like brisk beer.
29	62	34·2	62	15·2	A frothy light yeasty head on both bottles, on No. 1 being uncorked, carbonic acid gas escaped, which blew out a candle. No. 2 also discharged gas with considerable force, and a portion of yeast adhered to the bottoms of the cork.
30	58	27·8	60	13·0	No. 1 bottle still a yeasty-like head. No. 2, head nearly disappeared; carbonic acid still apparent in each.
Feb. 1		25·4		11·4	Went to still.

The above samples were carefully distilled in a retort, and the relative products according to the attenuation were not far different from the wash-back in which they had been placed, and which had been fermented in the regular way, and was rather below 0. The bottle No. 1, produced at the rate of a gallon of spirits for every 5·4 attenuated; and

No. 2 at the rate of a gallon for every 5 attenuated; while the back produced a gallon for every 4·5 attenuated.

The above experiment was made in the Government Experimental Distillery in the year 1840, by two experienced revenue officers, and under the author's inspection, while employed by Dr. Birkbeck in conducting certain operations then under investigation.

REPORTS

CONCERNING BEER SENT TO CALCUTTA.

In 1832, I brewed a small gyle of pale beer for the India market. The first worts were boiled one hour, the second one hour and a-half. I beg leave to subjoin the report made upon it in Calcutta.

"Calcutta, 8th August, 1832.—Report on two hogsheads of Black's pale ale, examined in the custom-house godowns of Messrs. Lyall, Matheson and Co.—Two hogsheads of Black's pale ale.—This pale ale, of superior quality, is well adapted for the India market, both in colour, body, and flavour.

(Signed) "John Browne and Co.,
" Coopers to the Honourable Company."

Another lot of this same beer went to Messrs. Watson and Co., and I beg leave, also, to insert a short extract of their letter to me, of date, Calcutta, 9th April, 1833.

"We wrote to you on the 17th of November, to which we refer you.—Your beer is now ripe, and confirms what we then wrote you; it is really most excellent, and, as such, we are disposing of it in small quantities, so as it may be known."

This, at all events, proves that long boiling is not essential to the preservation of beer; and I have come to the conclusion, that long boiling can do no good, but may do harm. Unless, therefore, longer time should be required for strength, one hour's boiling will sufficiently break the first worts, and two hours, at the utmost, will do the same by any other wort.

"*London*, *Dec.* 3. 1839.

"MY DEAR SIR,

"In answer to your note, I can only say with regard to your beer supplied me when in 'the Castle Huntly' the quality was highly approved of, not only by your acquaintance, but also the principal tasters in Calcutta, and by every one who drank it.

"I had some of Hodson's, and Ind and Smith's, but your's was preferred, not only on board, but in Calcutta, where it brought me Rs. 10 per hogshead more than either of the others. The advice I was recommended to give you was *not to imitate the brewing of others, but to adhere strictly to your own plan, when you must succeed.*

"Yours, very truly,
(Signed) "D. GRASSICK."

The beer was brewed in Spitalfields.

FOR the following remarks on Electricity, as connected with brewing, I am indebted to my friend Dr. Cumming, of 34, Lowndes-street, Pimlico, who has been some time engaged in investigating the effects of electricity on various substances:—

It has long been observed, that fermented liquors are soured after thunder storms, and it has not only been observed that fermented liquors are so affected, but also that butter, milk, animal food, and all organised matters, having a disposition to chemical change, are sometimes most rapidly decomposed after thunder. These changes we are induced to ascribe to electrical agency, from the well known fact, that animals killed by lightning almost immediately become putrid. Dr. Franklin relates a remarkable instance of the rapid decomposition of a "flock of sheep, assembled under a tree which were killed by a flash of lightning. The proprietor, desirous of saving something, sent persons next morning to flay them; but the putrefaction was such, and the stench so abominable, that they could not execute his orders. The sheep were consequently buried in their skins." We might adduce many well-attested instances of similar effects produced on animals struck by lightning; and it can be proved by the evidence of many butchers in this city, that serious losses are often sustained by the rapid putrefaction of meat after thunder: a fact with which philosophers have long been acquainted. Dr. Franklin* suggested (no doubt from his knowledge of these effects of electricity) that animals might be rendered tender for the table by being killed by lightning. We are prepared experimentally to prove, that such chemical changes in fermented liquors are promoted by electricity, and not only in fermented liquors, but in all matters subject to decomposition; and the popular belief in the influence of this wonderful agent, which has so long been entertained, being thus corroborated by experiment, we may, I think, look upon it as an established truth, that such chemical effects are produced by electrical changes, at least by those which take place during thunder.

There are, however, variations observable in fermentations and other chemical processes, when no thunder-storms occur. For instance, it has been noticed by many intelligent brewers, that their fermentations are more brisk during frost than they are during soft and warm weather, though in the latter case we might expect them to be rendered more active by the concurrence of a higher temperature. Bakers have observed similarly active states of the fermentation of their dough during frosty weather, while in soft and warm weather their fermentations are sometimes dull, and their bread apt to become sour.

---

* Vide Franklin's works, vol. vi. p. 231.

It has been noticed both by bakers and brewers, that their fermentations are brisk during high winds, and more especially during high winds from the east and north, when no change of temperature appears to be concerned. Many variations in chemical actions obviously take place, when no alteration of the temperature or other sensible qualities of the surrounding atmosphere can be observed, by which they might be produced. We are consequently inclined to think, *that changes take place in the electrical states of the earth and air*, not manifested to us by the phenomena of thunder and lightning, *by which variations may be produced in chemical actions, and probably, chemical affinities brought into play, which might remain quiescent without their agency.*

We learn from the researches of Beckerel*, by what feeble electrical forces great chemical results may be produced. Slight electrical polarity, produced by the temperature of a piece of metal being higher at one end than at the other, is sufficient to excite certain chemical actions.† From these facts, we may imagine the great power those alterations in the electrical states of the earth and air, which are constantly occurring in connection with meteorological changes, must have on chemical processes.

Mr. Weekes, of Sandwich, has kept a register of the electrical changes of the atmosphere for the last three years, which may be seen in the Transactions of the London Electrical Society. The instrument he uses for ascertaining these changes, is a wire for collecting the atmospherical electricity, extended between two elevated points, and connected with them by non-conductors. From the centre of this atmospherical wire, another wire extends to the electroscope, by which the power and appearance of the electricity collected by the former are manifested. To give an idea of the quantity thus collected, I shall simply give Mr. Weekes' report for 9th May 1841, as per the register for that month:—"During a rain-and-hail shower, splendid and nearly incessant torrent of sparks for nearly an hour. The electric current exhibits singular intensity, rapidly decomposing fluids, igniting combustible substances, &c. The lateral discharge partially consumed an iron nail three and a-half inches long, with the brilliancy of an ordinary firework." We have here given one of the more decided instances of electrical changes occurring without thunder; but by a perusal of the register for three years, it will be seen, that changes are constantly observed in connection with changes of weather; and even without any decided change of weather, we find this influence, though to a much less extent, ever fluctuating and unsteady. We may consequently presume, if *chemical actions are affected by electrical influence*, that from the highest intensity of those electrical movements to the most feeble, *chemical effects*, *varying in degree and kind*, are produced in matters prone to decomposition. By observing the phenomena which pass around us, we may soon become convinced of the truth of these remarks. For instance; from ponds, the bottoms of which are composed of earthy and vegetable matters, we have, prior to changes of weather, and especially prior to and during rain, quantities of gas escaping in bubbles. Our sense of smell affords evidence of the emanation of effluvia from putrescent matters, being more abundant at one time than another; and this is so generally observed in London, and its connection with changes of weather so obvious, that many consider an increase of stench from drains to be a sure premonition of rain.*

---

* Scientific Memoirs, vol. i., Beckerel on the Chemical Effects of Electric Currents.

† Vide Transactions of the London Electrical Society, part v. p. 281., M. Martens on the Passivity of Metals.

Some imagine, from the frequent occurrence of stench from sewers and drains, during easterly winds, that currents of air from that direction enter the drains, and force the stench back into the houses. But we know, that electrical movements are much more powerful than usual during easterly wind, and previous to and during rain, and consequently the more abundant extrication of gases and effluvia under such circumstances, may more properly be looked upon as an evidence of the *chemical effects of electricity.*

It has been noticed by many of our army medical officers at Gibraltar, that it is extremely difficult to keep armour clean during the north-east winds, which they call the black Levanters. These winds are certainly said to be moist, and this may probably be considered sufficient to account for their oxidating effects; but in order to ascertain that such processes of oxidation are affected by some less manifest influence, we have made comparative observations as to the time required, to oxidate or rust bright but unpolished plates of iron. When these plates are slightly sponged over with distilled water, the moisture will at one time evaporate without leaving a speck of rust, while at another, a covering of rust forms upon it almost immediately. We have found this more rapid tendency to oxidation, coincident with a high state of the electrical tension of the earth, upon which variations in other processes of oxidation also appear to depend. For instance, it is a matter of general observation, that our fires burn more brightly than usual, during frosty weather. A similar activity of combustion is also observed during high winds, especially when from the east or north. We have noticed the more obvious changes of the process of combustion, and also of the oxidation of iron, for two years, at the same time keeping a register of the electrical tension of the earth; and during this period we have found the more evidently bright states of combustion corresponding so uniformly with high electrical tension, that they may probably be considered as cause and effect.

---

* **Vide Sir Gilbert Blane on the Diseases of Seamen, page 267.**

From these facts we may, I think, conclude that fermentations must be greatly affected by electrical agency, and that many variations in those processes commonly ascribed to variations in the quantity or quality of the yeast employed, to temperature, &c. &c. really depend upon the changes of this more powerful and extensive influence. The very remarkable instance given by Mr. Black, page 35. of the suspension of fermentation before a thunder-storm, and its immediate recommencement when the wort was pumped out of the vat embedded in the earth, into casks placed on wooden stands, affords a strong proof of the power of electricity over these processes. We cannot doubt but the cessation of the process was in this instance the effect of the negatively electric state of the earth which is generally observed before thunder. Whether the isolation produced by transferring the liquor from the vat into casks supported by wooden stands, was anywise effective in its recommencement, we cannot say. Negative surfaces do not appear to promote the chemical changes to which such liquors are disposed, at least we think this a fair inference from the results of the following experiments.

Into three pots of similar size and shape, two of them made of copper, and one of wood, we put equal quantities of wort. We kept them precisely in the same circumstances; but one of the copper pots was rendered negative by having a disk of zinc in its bottom. In the course of three weeks the worts in the other two pots underwent spontaneous fermentation, became sour, and ultimately putrid, whereas that in the negative pot, continued free from every appearance of fermentation and chemical change, and as sweet to the taste for months as it was at the beginning.* These experiments have been frequently repeated with the same results; and if it be proved by further investigation, that chemical changes in worts are retarded by negative surfaces, coolers may be constructed on this principle, and reservoirs for preserving beer, in which a second fermentation or fret (as it is technically termed) will be less apt to occur: an accident, which is so often a cause of great loss to practical brewers. Vessels composed of zinc and copper are, of course, objectionable on account of their poisonous qualities. We find, however, from the investigations of M. Martens, member of the Royal Academy at Brussels, that iron may be rendered passive or negative, by a dull red heat, insomuch that it is not affected by the unfuming nitric acid of commerce, which powerfully affects common iron. The immersion of iron in highly concentrated nitric acid has the same effect, and so has also the crystallisable, or highly concentrated acetic acid. Passive vessels may, consequently, be made of this metal which is, I believe, already used for these purposes, without this important preparation.

---

* This the Author had the opportunity of witnessing.

It is not our intention to enter into any theoretical consideration of these phenomena; we merely point them out to practical men, in order to induce them to avail themselves of the opportunities they enjoy, in conducting their great processes, by their observations and experiments, to aid us in tracing the effects of an agent, which we have reason to consider, not only influential in producing variations in the operations of the brewery, but, what is still more important, variations in the constitution of our atmosphere, and probably effects on the functions of life, the comprehension of which may aid us, both in the prevention, and better treatment of epidemic and contagious diseases.

We may observe, that brewers cannot too carefully avoid the circumstances calculated to produce electro-chemical action, pointed out by Mr. Black; for it cannot be doubted, from the proofs he adduces, that local galvanic action is produced by the use of metallic cocks and chains of pipes, which, being acted upon by the wort, cause unsoundness.

Although the subject of electricity, as connected with brewing, has already been pretty fully treated of in the former part of this work, yet as electricity and electro-chemical action, as connected with fermentation, are at last beginning to attract a little more attention than they have hitherto done, a few additional remarks upon the subject may not be deemed superfluous. They will tend further to show the extraordinary influence exercised by that still incomprehensible fluid or body, not only upon fermentation but upon everything connected with the manufacture of beer, and also, as it is now thought, upon every process, both natural and artificial. My former remarks were principally confined to the injurious effects of galvanism, as producing an electro-chemical action in the process of fermentation. These injurious effects I considered to have been caused by chains of pipes, consisting of various metals, having been connected with the fermenting tuns, and other departments of the brewery; and many facts and cases in point were mentioned, showing that this was the true cause. Many people, however, were led to suppose that, as this action was not so hurtful at some times as at others, its injurious effects had no foundation in reality; but every one, more or less acquainted with the principles of electrical science, must admit the fact, that different oxidizable metals in contact cannot be immersed even in water, without the excitation of galvanic currents. When, however, such combinations of metals are immersed in acidulated liquors, such as worts undergoing fermentation, currents, more or less powerful in proportion to the quantity of acid contained in those liquors, *must be produced.*

Acids increase the conducting power of liquors, and upon this property depend their effects of increasing the power of galvanic currents. From causes already stated and explained in my Treatise on Brewing, acids are sometimes formed in the worts, even in the coolers. Hence it may be easily comprehended that electro-chemical action must, in such circumstances, be more powerful, and, consequently, *more hurtful.* When the worts are sound and sweet, the currents are proportionately feeble; *but they never can be absent* so long as metallic combinations are used in the brewery: even when most feeble, they constitute a force* superadded to, or giving direction to the chemical affinities engaged in the fermenting process, and they must constantly operate as disturbing causes, increasing or modifying a process, the success and perfection of which depends on its being permitted to go on to its completion, uninfluenced by any force save its own intestine affinities. It is now an established law, incontestibly proved by the experiments of Faraday, Daniell, and other philosophers, that the electrochemical action of a current of electricity is always definite, and directly proportionate to the absolute quantity of electricity which circulates; and however feeble such a current may be, it must, if it at all exists, *act electro-chemically.*

We have already shown how impossible it is to avoid galvanic currents, if metals are used; but common electricity, circulating in currents, acts electro-chemically, as well as galvanism; and we may conceive, when electro-currents are slowly descending to the earth from superincumbent clouds, that they must, by the extent and conducting power of chains of pipes, be powerfully concentrated and directed to the worts with which such pipes are connected, and that thus an agent is rendered deleterious by being so collected, which would, under ordinary circumstances, have little effect.

---

* See "Faraday's Experimental Researches on Electricity," vol. i. p. 148., par. 518.

From these observations it is evident that the great want of uniformity in the process of brewing, now so much objected to, and the consequent injury to the beer, can never be fully got the better of until these causes of failure are in some way or other removed. I shall, in the mean time, beg leave to refer to what has been previously said upon this subject in a former part of this work, and shall now proceed to state some curious effects which have also come under my notice, with regard to the influence of atmospheric electricity upon fermentation.

Dr. Cumming's observations as to the preservative qualities of negative vessels for worts or beer, are well worthy of attention; if negative utensils tend to prevent acidity in worts, which they no doubt do, they must have the same effect on beer, with this further advantage, that, as it retards fermentation, it must prevent fret, which is a spurious or second fermentation, proceeding from an increase of temperature, or other atmospherical changes. It has been always found, that the more isolated vats, or casks in which beer has to be kept, can be rendered, the better chance has the beer of not being injuriously affected by electricity. If vats, therefore, can be constantly kept in a negative state, the beer will be much less liable to suffer from *fret*, than when subjected to every electrical change which may occur.

Atmospheric Electricity.

From Dr. Cumming's remarks, it will be seen, that when worts or beer were placed in a state of positive electricity, they very rapidly went to decay, and got sour; but when placed in a negative vessel, they would keep for an indefinite length of time without undergoing any change. It was also found that when yeast was applied, the worts under positive electricity very rapidly got into a state of fermentation, and soon became acid; while in the other, or negative state, little or no fermentation took place, and that which did occur did not produce any acidity, a little frothy matter appeared upon the surface, unaccompanied by any other change. This accounts for the anomalies which take place in fermentation when the appearance of the atmosphere indicates thunder. It is a common observation that any man can brew in winter, and no doubt before the introduction of these metallic mains, &c., now in such common use in the brewery, much less difficulty was experienced in the process of fermentation in the winter months, because fewer electrical changes take place at that season (having seldom thunder-storms to dread) than in warmer weather or summer. Galvanism, however, now neutralizes these advantages, and the process of brewing has become about as uncertain during winter as in the heat of summer, thereby causing the great want of success and uniformity already mentioned.

Let us now revert to the fluctuations which take place in the fermenting tuns, when the appearance of the atmosphere indicates thunder.

It is generally supposed, that before thunder the atmosphere is positively, and the earth negatively, electrified; but suppose it the reverse, the same anomalies would take place in fermentation, and similar effects be produced, — viz., that positive electricity would cause fermentation to go on too rapidly, while negative electricity would altogether prevent it: thus showing, that, whenever the equilibrium is unduly disturbed during that process, fermentation becomes irregular, and of course uncertain.

When fermentation is going on as regularly and prosperously as possible, should the process suddenly cease or become inactive, it indicates an approaching thunder-storm, and during this inactivity no addition of yeast will have any effect in causing it to go on. It may be remarked, however, that no additional acidity takes place, nor does any other harm happen to the worts during this cessation than merely the delay. Very soon after the thunder begins, the fermentation will resume its activity, and with a very little additional yeast, will get on, perhaps, more vigorously than before, and should any acidity be produced, it will be at this time, and not during the state of inactivity I have already mentioned as occurring before the commencement of the storm. I have observed these anomalies to take place more than once during the progress of the same fermentation, and could, if necessary, mention day and date for them. We at present know no means of totally preventing the influence of electricity on fermentation, but its occurrence may be often ameliorated, and sometimes even averted, by a judicious arrangement of the fermenting tuns, but not by the admixture of metals already adverted to, which at all times prevents either regularity or uniformity in the process. The fermenting vessels should be in every way as perfectly insulated as possible, and not in any way exposed to the steam arising from other parts of the brewery, the influence of which will immediately destroy the fermentation by throwing down the head. They should be placed upon brick pillars, and if supported by baked wooden bearers, so much the better, and each one should be placed separately by itself. These precautions will at all times be found serviceable. Other means may be afterwards discovered which may be more effectual, but these would require careful investigation. It cannot now be doubted that failure in the success of the process of fermentation is greatly influenced by electrochemical agency. It also appears that if the electrical equilibrium be disturbed or destroyed during any part of the process of fermentation by the intervention of atmospheric electricity, an entire stop is for a time put to the process in some instances, while in others it is accelerated to such a degree as to produce acidity. The equilibrium being in both cases destroyed, no uniformity of action can go on, and more or less free acid will be produced in the beer according to circumstances, as a comparison of different beers by means of the litmus test will distinctly show, for in some cases where the electrochemical action has been strong, instead of a brownish-red colour, a pretty bright red will appear, showing that a considerable excess of free acid has been generated.

Let our great brewers then, instead of being led away by vague assertions, unauthorised by practical experience, and unattended with any real benefit,—but too often the contrary,—devote a little more attention to chemistry, by means of which most other arts have been so greatly benefited. We shall thus, it is to be hoped, do away with the imputation of our being at present excelled by other countries, in the production of a beverage which has been so long considered as peculiarly our own.

BAVARIAN BEER.

The art of brewing has been long practised in Bavaria, and it is also said that it was first introduced into this country by the Germans.

In some parts of that empire premiums are awarded by the Government for the production of the best beer. That brewed in Bavaria has lately got into great repute, which is chiefly owing to its having been noticed in the writings of Professor Liebig, who there states that its superiority is in consequence of the adoption of, or perhaps the adhering to, a different mode of fermentation to that now practised in this country.

We know, however, that the same mode of culture will not suit every soil, neither will the same process of brewing answer in every climate or even district, nor will the same description of beer please every palate. Our tastes are principally acquired from custom, and vary according to the way in which we have been brought up. The rank fish-oil so highly relished by the Laplanders would not be tasted in this country unless from necessity, which will reconcile us to almost anything. I do not, however, by this remark, mean in any way to disparage the Bavarian beer, but I believe it may be as good as, but certainly not (as Professor Liebig asserts it to be,) better than the best brewed in this country. I have a very high respect for that eminent chemist, but I cannot think that the arts and sciences are better known in Germany than they are here.

The samples of Bavarian beer which have been examined in England by competent judges, have not been considered in any way superior to that of the best of the same description of beer brewed in this country, but rather the reverse. The Bavarians, however, have one advantage, as Professor Liebig says, which we do not possess in this country; which is, that they are not restrained from making use of any harmless bouquets to flavour their beer, as is done in wines, which the excise laws here do not permit.

Although the Bavarian beer, therefore, may please very well at home, it does not appear to be adapted for exportation, and its mode of manufacture may not perhaps suit it for that purpose. Liebig's predilection in favour of the Bavarian mode of fermentation may proceed from a misconception of that adopted in this country, or possibly from his never having had it in his power fully to compare the two processes together. My friend, Mr. Maugham, the analytical chemist, who has lately travelled over most parts of Germany, assures me, that without doubt there is much less free acid in their beer than in ours; but this excess of acidity in our beer may not proceed so much from any superiority in their mode of brewing, as from the new mode of constructing and arranging the utensils employed in the process, recently introduced into this country. These have a decided tendency to produce acidity, and also to prevent all uniformity in the fermentation of the beer. This has been fully explained in former parts of this work, and will again be adverted to.

Bavarian beer seldom exceeds in the specific gravity of the worts 1060, water being 1000; this is about the same as that of our Indian beer, which should be attenuated when the fermentation is fully completed, down to 1006 or 1008 specific gravity by the excise instrument, or from 3 to 4 by Long's. This degree of attenuation may, no doubt, be obtained by the Bavarian method; but it may be very doubtful whether worts of twice that gravity or more, which are much used in this country, could be sufficiently attenuated by that process, at least in any reasonable time. As Liebig, however, does not give us any information either respecting gravities or attenuations, we have no data to go by. He merely states that the beer is better, contains more alcohol, and is invariably superior in quality and stability to any other whatever, thus leaving the process merely a matter of conjecture.

With regard to the quantity of alcohol contained in any fermented liquor, it can only be ascertained by distillation, or some similar process, and the amount of it is invariably in proportion to the original specific gravity of the worts or must, and the degree to which it has been attenuated.

We are thus left entirely in the dark, and from thence can only infer that the Bavarian brewers have not yet got beyond the good old system so long acted upon in this country, and perhaps still in some parts — viz., rules founded on practical experience alone.

We shall now proceed to mention some of the points on which the two processes differ. In the first place, their tedious mode of making the extract must be very objectionable, particularly in warm weather, as in so great a length of time as they occupy in that process, the worts, at least in this country, would very often get tainted, and thus injure the beer. In the next place, according to Liebig, their process of fermentation occupies from four to six weeks, and is carried on in very shallow vessels, possibly not more than two feet in depth. This alone would be an insuperable objection to its being adopted in this country, even were it in any way more beneficial, which, from all that we as yet know on the subject, is very doubtful. It appears to be nearly the old system as it has been carried on from time immemorial, being an adherence to the good old usages of our ancestors, which is not in accordance with Liebig's general doctrines. Another reason why this process could not be profitably introduced into this country, is the multiplicity of the fermenting tuns requisite, and the time employed in the fermentation, which utensils would require the expenditure of a fortune for that department alone, and would also occupy many acres of ground, which, in one of our great establishments, would be a rather serious consideration. Liebig says that the Bavarian fermentation, from its being carried on under ground, and at much lower temperatures than ours, is on that account much less liable to get acidified, and he gives several reasons for that being the case; but I confess I am not chemist enough to understand the great advantages by which their practice is rendered superior to our own. It appears to me that the processes are similar in both countries, although differently conducted; and, to judge from the only statements laid before us, it does not appear that any advantage can be gained by so tedious and expensive an operation as the Bavarian. It is said by persons who have travelled in that country, that the beer in the common public-houses is generally very cloudy, and is also laxative, and consequently would not suit our coal-heavers or other hard workers.

Professor Liebig also says somewhere, that the excess of gluten left in beer is one great cause of its decay. We find by chemical analysis that there is but three per cent. of gluten in barley, and two per cent. of that disappears in the process of malting, so that only one per cent. of that substance is left in the malt; now, whence can that excess of gluten proceed? but were it even so, such excess could very easily be got rid of. But we shall not at present pursue this subject further: it is no doubt presumption in me to differ in opinion from so high an authority as that of Liebig, but still, as a practical man, I am anxious to proceed according to ascertained facts.

We shall now describe the process of fermentation as carried on in this country, in order, if possible, to discover in what the Bavarian mode excels it. The great object of both is to avoid acidity, and before the introduction of what I call the galvanic apparatus into our breweries, we were as little liable to acidity as our neighbours: now, however, it may be different. Our process of mashing or making the extract, if properly conducted, need not exceed at the utmost six hours, by which time everything that is of any value in the malt will be obtained, and thus the risk of harm, which is likely to occur to the worts when the longer process is employed, may be avoided.

The whole of the worts should by this time be in the copper, even if two boilings be necessary: more than two boilings are now but seldom used.

In moderately cold weather, an experienced brewer can always conduct his fermentations at temperatures of from 50° to 75°, or, at all events, 80°. I mean when the process is carried to the desired extent, and I think Liebig admits these heats to be free from any of that danger which he dreads from higher temperatures.

The time occupied in the fermentation need not exceed from forty to sixty, or at most eighty, hours, varying according to the strength and quality of the beer. The beer is thus much less liable to be injured by atmospheric electrical fluctuations than by longer processes, which often prove detrimental to it.

During the fermentation, when well conducted, there should be such an accumulation and constant discharge of carbonic acid gas, as to preclude any communication with the atmosphere, at least under common circumstances. When the fermentation has been carried to the desired extent, the beer (I do not now speak of the process called skimming) is discharged from the fermenting-tun into smaller vessels or casks, for the purpose of throwing off the yeast. During this time, also, the vessel is frequently filled up, in order to assist the discharge of the yeast; neither can it in this stage of the process have any connection with the atmosphere, unless from electrical interference, which as yet we have no means of entirely avoiding. This operation may again occupy about two or three days, according to circumstances, to allow the beer to get steady and cool. It is then stowed away in the same casks, or racked into others, or, perhaps, into large isolated vats, which may be in a manner hermetically sealed, excepting a small vent-peg, to allow the escape of any accumulation of gas, which might otherwise burst the vat.

The beer thus stowed away in well ventilated storehouses may, by proper means, be at all times, even in the heat of summer, kept at a temperature not higher than from 54° to 60°; and thus, when sent out for sale, its temperature will not be much higher than that from the underground Bavarian cellars. How, then, can this beer labour under any disadvantage when compared with that brewed in Bavaria? or what can prevent it (if not originally contaminated), under proper treatment and good management, from rivalling or even surpassing the best in that country? We have, in every respect, better materials of all descriptions. We have seen beer brewed here which has stood on ullage only half full for eighteen months still quite sound, and with but very little perceptible change.

Liebig admits, page 192., second series, that the quality of the Bavarian beer depends very much upon the skill and experience of the brewer, and that the finest beer, even in that country, can only be attained in rare and extremely happy instances; thus admitting a similar uncertainty with regard to its quality as must be experienced in every country, until the nature and laws of fermentation can be more scientifically explained than as yet we can pretend to do.

I have only to remark further, that the most able chemist, unless practically acquainted with the business, must labour under very great difficulties in forming practical conclusions respecting the fermentation of beer, as, in many cases, he can only be guided by the opinions of uneducated men, who can adduce no scientific reasons for the information they may give, but merely that they have found it to answer in their own practice and locality, whereas place them in different localities or situations they might totally fail, as has happened in innumerable instances.

No certain or invariable rules, therefore, can be laid down for any one particular system of brewing, as applicable in all cases. We must, in a great measure, be guided by circumstances and locality, combined with the scientific knowledge and experience of the brewer.

CAPING ON FOR SMALL BEER.

It is a common practice with many brewers, after having made a certain proportion of ale, to make small beer from the same malt. To assist the small beer, or make it better, they sprinkle over the same mash an additional quantity of fresh malt, and again proceed with the mashing as before; this is called caping on for the small beer.

This manner of caping on, however, is by no means the most profitable mode of proceeding, as the new malt will not give so good an extract as when differently treated. The small quantity of new malt, instead of being sprinkled on the former mash, should, in the first place, be mashed regularly by itself, as if intended for a separate brewing; and, when the extract is fully formed, should be thrown into the mash-tun with the other malt, and the mashing be then proceeded with as usual. The fresh malt when treated in this way will be found to be more productive, and give a better extract, than when sprinkled over without mashing. This mode of treatment may be managed with but very little trouble. The small quantity of fresh malt used may be placed in an open-headed butt or puncheon, or whatever other cask may be found suitable, and the mashing be then proceeded with as usual. When the extract is thoroughly made, it may be thrown into the tun; or, to save time, the little mash may be made while the last tap or worts are running from the mash-tun. These little improvements, which are but seldom thought of, will be found to be well worth the trifling extra trouble they require.

OF THE COLOUR OF LONDON PORTER.

LONDON porter has of late years become of nearly the same colour as Dantzic black beer, which is, perhaps, another *improvement* of the present day. This alteration in the colour is said to have been adopted merely to humour the public taste. It is very doubtful, however, if the public have been consulted upon the subject, or ever had any voice in the matter. Owing to the causes already mentioned, porter of a brilliant colour, as formerly, is seldom now to be seen; and the common porter, as generally drunk out of pewter pots, is often so muddy as to be complained of as being unpleasant to the eye. It is just possible, that, to please the public taste as to colour, it may become necessary to make it (the porter) as black as ink; and this may also be a means of preventing the public from judging whether that which they drink is muddy, or grey, or sometimes even both.

This opinion, however, is merely a *surmise*, which may or may not be the case. It cannot, however, be considered by the public as any very great improvement, inasmuch as it is even now occasionally called, in *common parlance*, black beer, or black strap.

Porter was originally made in imitation of three descriptions of beer, much in use about the beginning of the last century. These different qualities were called pale, amber, and brown, and were mixed with each other in the pewter pots in such proportions as to please the different palates of the drinkers, who ordered one, two, or three threads, as they termed it, according to their respective tastes.

A brewer, however, of that day, to save the trouble of having to blend these three different qualities together, thought of brewing a beverage which should partake of the flavour of the whole when mixed, and in this he succeeded. The principal consumers were porters and other hard labourers, whence it got the name of porter, which it has retained from that time, and from its excellence has been celebrated all over the world as London porter.

It seems, therefore, to be a pity, should its new colour, although given by brewers solely to please the public, be the means of changing its original and respectable designation into one so discreditable as that of *black strap.*

CONCLUSION.

By the formulæ already given, any one capable of making common calculations may conduct a brewing with any quantity of malt, from one quarter to four hundred, on precisely the same plan. They, however, who are in the practice of brewing on a great scale, need no instructions for calculating.

All kinds of irregular fermentation have been so minutely described, as to place it in the power of every brewer to know the indications of unsoundness, whenever they may appear; it has therefore been thought unnecessary to trace an irregular fermentation through all its stages. The only mode of avoiding it is to detect and remove the causes which induce irregularities. That this can be accomplished by those who have properly directed their minds to the subject, there cannot be the slightest doubt.

The process of brewing porter or stout may be conducted in precisely the same manner as brewing ale; the difference in flavour proceeds entirely from the brown and roasted malt used in making brown beer.

It has been already stated, that it is impossible to describe, by writing, certain aromas and appearances, denoting soundness or the contrary, which take place in the process of brewing, but particularly during fermentation, so as to make them intelligible to any one who is not already thoroughly acquainted with them, or who may not have had an opportunity of having them practically pointed out.

THE END.

London:
Spottiswoodes and Shaw,
New-street-Square.

BOOKS OF GENERAL UTILITY, ETC.

I.

MODERN COOKERY, in all its Branches, reduced to a System of Easy Practice. For the use of Private Families. In a Series of Receipts, all of which have been strictly tested, and are given with the most minute exactness. By Eliza Acton. New Edition, to which are added Directions for Carving. Fcp. 8vo. with Plates and Woodcuts, 7*s.* 6*d.*

II.

BRITISH WINES, CORDIALS, AND LIQUEURS. The Whole Art of making British Wines, Cordials, and Liqueurs, in the greatest Perfection; as also Strong and Cordial Waters. With a Collection of Valuable Recipes for Brewing Fine and Strong Ales, and Miscellaneous Articles connected with the Practice. By James Robinson. Fcp. 8vo. 6*s.*

III.

PRESERVATION OF MEAT AND FISH. The Whole Art of Curing, Pickling, and Smoking Meat and Fish, both in the British and Foreign Modes. With many useful Miscellaneous Receipts. By James Robinson, Eighteen Years a Practical Curer. Fcp. 8vo. 4*s.* 6*d.*

IV.

AN ENCYCLOPÆDIA OF DOMESTIC ECONOMY; comprising such subjects as are most immediately connected with Housekeeping: as, The Construction of Domestic Edifices, with the modes of Warming, Ventilating, and Lighting them—A description of the various articles of Furniture, with the nature of their Materials—Duties of Servants, &c. &c. &c. By Thomas Webster, F.G.S.; assisted by the late Mrs. Parkes. New Edition. 8vo. with nearly 1,000 Woodcuts, 50*s.*

V.

THE TREASURY OF NATURAL HISTORY; or, A Popular Dictionary of Animated Nature: in which the Zoological Characteristics that distinguish the different Classes, Genera, and Species are combined with a variety of interesting Information illustrative of the Habits, Instincts, and General Economy of the Animal Kingdom. To which are added, a Syllabus of Practical Taxidermy, and a Glossarial Appendix. Embellished with Nine Hundred accurate Engravings on Wood, from Drawings made expressly for this work. By Samuel Maunder. New Edition. Fcp. 8vo. 10*s.* cloth; bound in roan, 12*s.*

VI.

THE BIOGRAPHICAL TREASURY; consisting of Memoirs, Sketches, and brief Notices of above 12,000 Eminent Persons of all Ages and Nations, from the Earliest Period of History; forming a new and complete Dictionary of Universal Biography. By Samuel Maunder. New Edition, revised throughout, and containing a copious Supplement. Fcp. 8vo. 10*s.* cloth; bound in roan, 12*s.*

VII.

THE TREASURY OF HISTORY; comprising a General Introductory Outline of Universal History, Ancient and Modern, and a Series of separate Histories of every principal Nation that exists; their Rise, Progress, and Present Condition, the Moral and Social Character of their respective Inhabitants, their Religion, Manners, and Customs, &c. By SAMUEL MAUNDER. New Edition. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

VIII.

THE SCIENTIFIC AND LITERARY TREASURY; a new and popular Encyclopædia of Science and the Belles-Lettres; including all Branches of Science, and every Subject connected with Literature and Art. The whole written in a familiar style, adapted to the comprehension of all persons desirous of acquiring information on the subjects comprised in the work, and also adapted for a Manual of convenient Reference to the more instructed. By S. MAUNDER. New Edition. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

IX.

THE TREASURY OF KNOWLEDGE, AND LIBRARY OF REFERENCE: in Two Parts. 18th Edition, thoroughly revised and enlarged. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

⁂ The principal contents of the present new and thoroughly revised edition of "The Treasury of Knowledge" are—a new and enlarged English Dictionary, with a Grammar, Verbal Distinctions, and Exercises; a new Universal Gazetteer; a compendious Classical Dictionary; an Analysis of History and Chronology; a Dictionary of Law Terms; a new Synopsis of the British Peerage; and various useful Tabular Addenda.

X.

THE CABINET LAWYER: a Popular Digest of the Laws of England, Civil and Criminal; with a Dictionary of Law Terms, Maxims, Statutes, and Judicial Antiquities; Correct Tables of Assessed Taxes, Stamp Duties, Excise Licenses, and Post-Horse Duties; Post-office Regulations, and Prison Discipline. Fourteenth Edition, enlarged, and corrected throughout, with the Legal Decisions and Statutes to Michaelmas Term, 10 & 11 Victoria. Fcp. 8vo. 10s. 6d.

XI.

DICTIONARY OF ARTS, MANUFACTURES, AND MINES; containing a clear Exposition of their Principles and Practice. By ANDREW URE, M.D. F.R.S. M.G.S. M.A.S. Lond.; M. Acad. N.L. Philad.; S. Ph. Soc. N. Germ. Hanov; Mulii. &c. &c. New Edition, corrected, 8vo. with 1,240 Engravings on Wood, 50s.

SUPPLEMENT of RECENT IMPROVEMENTS. New Edition. 8vo. with Woodcuts, 14s.

LONDON: LONGMAN, BROWN, GREEN, AND LONGMANS.

NEW WORKS
IN
MISCELLANEOUS & GENERAL LITERATURE,
PUBLISHED BY
MESSRS. LONGMAN, BROWN, GREEN, AND LONGMANS,
PATERNOSTER ROW, LONDON.

Classified Index.

Agriculture and Rural Affairs.

Pages.
Baydon On valuing Rents, &c. - 4
Crocker's Land-Surveying - - 7
Johnson's Farmer's Encyclopædia 14
Loudon's Agriculture - - - 17
" Self-Instruction - - 17
" Lady's Country Compan. 17
Low's Elements of Agriculture - 18
" Cattle Breeds - - - 18
" On Landed Property - - 18
" On the Domesticated Animals 18
Parnell On Roads - - - 23
Thomson On Fattening Cattle - 30

Arts and Manufactures.

Baker's Railway Engineering - 3
Ball on Manufacture of Tea - - 3
Brande's Dictionary of Science, &c. 5
Budge's Miner's Guide - - - 5
Cartoons (The Prize) - - - 6
Cresy's Civil Engineering - - 7
D'Agincourt's History of Art - 7
Dresden Gallery - - - - 8
Eastlake On Oil Painting - - 8
Evans's Sugar-Planter's Manual - 9
Fergusson On Architecture, &c. - 9
Gwilt's Encyclop. of Architecture 11
Haydon On Painting and Design - 11
Holland's Manufactures in Metal - 15
Jameson's Sacred and Legendary Art 14
Loudon's Rural Architecture - 18
Moseley's Engineering - - - 22
Porter's Manufacture of Silk - - 15
" " Porcelain & Glass 15
Reid (Dr.) On Ventilation - - 24
Scoffern On Sugar Manufacture - 26
Steam Engine, by the Artisan Club 3
Twining On Painting - - - 31
Ure's Dictionary of Arts, &c. - 31
Wood On Railroads - - - 32

Biography.

Andersen's (H. C.) Autobiography 3
Bell's Eminent British Poets - 15
Collins's Life of Collins - - 6
Dunham's Early British Writers - 15
" Lives of British Dramatists 15
Forster's Statesmen - - - 15
Foss's English Judges - - - 10
Gleig's Military Commanders - 15
Grant's Memoir & Correspondence 10
Humphreys's Black Prince - - 13
James's Life of the Black Prince - 14
" Foreign Statesmen - - 15
Kindersley's De Bayard - - 14
Leslie's Life of Constable - - 16
Mackintosh's Life of Sir T. More - 19
Maunder's Biographical Treasury - 21
Roscoe's British Lawyers - - 15
Russell's Bedford Correspondence 4
Shelley's Literary Men of Italy, &c. 15
" French Writers - - 15
Southey's British Admirals - - 15
" Life of Wesley - - 28
" Life and Correspondence 28
Stephen's Ecclesiastical Biography 29
Taylor's Loyola - - - - 30
Townsend's Eminent Judges - 31
Waterton's Autobiography & Essays 32

Books of General Utility.

Acton's Cookery - - - - 3
Black's Treatise on Brewing - - 4
Cabinet Lawyer - - - - 6
Donovan's Domestic Economy - 15
Hints on Etiquette - - - 12
Hudson's Executor's Guide - - 13
" On Making Wills - - 13

Pages.
Loudon's Self-Instruction - - 17
" Lady's Companion - 17
" Amateur Gardener - 17
Maunder's Treasury of Knowledge 20
" Biographical Treasury 21
" Scientific Treasury - 20
" Treasury of History - 21
" Natural History - - 20
Parkes's Domestic Duties - - 23
Pocket and the Stud - - - 24
Pycroft's English Reading - - 24
" Collegian's Guide - - 24
Reader's Time Tables - - 24
Rich's Comp. to Latin Dictionary 24
Riddle's Latin Dictionaries - - 25
Robinson's Curing, Pickling, &c. 25
" British Wines - - 25
Rowton's Debater - - - - 26
Short Whist - - - - - 27
Suitor's Instructor - - - 29
Thomson On the Sick Room - - 30
Thomson's Interest Tables - - 30
Webster's Domestic Economy - 32
Zumpt's Latin Grammar - - 32

Botany and Gardening.

Ball On the Cultivation of Tea - 3
Callcott's Scripture Herbal - - 6
Conversations on Botany - - 6
Evans's Sugar-Planter's Manual - 9
Henslow's Botany - - - - 15
Hoare On Cultivation of the Vine - 12
" On the Roots of Vines - 12
Hooker's British Flora - - - 12
" Guide to Kew Gardens - 12
Lindley's Theory of Horticulture - 16
" Orchard & Kitchen Garden 16
" Introduction to Botany - 16
" Synopsis of British Flora 16
Loudon's Hortus Britannicus - 18
" " Lignosis Londinensis 18
" Amateur Gardener - 17
" Self-Instruction - - 17
" Trees and Shrubs - - 17
" Gardening - - - 17
" Plants - - - 17
Rivers's Rose Amateur's Guide - 25
Rogers's Vegetable Cultivator - 25
Schleiden's Botany, by Lankester 26

Chronology.

Allen On Prerogative - - - 3
Blair's Chronological Tables - 4
Bunsen's Ancient Egypt - - 5
Nicolas's Chronology of History - 15
Riddle's Ecclesiastical Chronology 25

Commerce & Mercantile Affairs.

Banfield and Weld's Statistics - 3
Gilbart's Treatise on Banking - 10
Gray's Tables of Life Contingencies 11
Lorimer's Letters to a Young Master Mariner - - - - 17
M'Culloch's Commerce & Navigation 19
Reader's Time Tables - - - 24
Steel's Shipmaster's Assistant - 29
Thomson's Interest Tables - - 30
Walford's Customs' Laws - - 31

Geography and Atlases.

Butler's Geography and Atlases 5 & 6
De Strzelecki's New South Wales - 8
Erman's Travels through Siberia - 9
Forster's Geography of Arabia - 10
Hall's Large Library Atlas - - 11
M'Culloch's Geographical Dictionary 19
Mitchell's Australian Expedition - 21
Murray's Encyclop. of Geography - 22
Parrot's Ascent of Mount Ararat 23

History and Criticism.

Pages.
Barrett's Bible Criticisms - - 4
Bell's History of Russia - - 15
Blair's Chron. and Histor. Tables - 4
Bloomfield's Edition of Thucydides 4
" Translation of do. - 4
Bunsen's Ancient Egypt - - 5
Coad's Memorandum - - - 6
Cooley's History of Discovery - 15
Conybeare and Howson's St. Paul 6
Crowe's History of France - - 15
De Sismondi's Fall of Roman Empire 15
" Italian Republics - 15
Dunham's Spain and Portugal - 15
" Middle Ages - - 15
" German Empire - - 15
" Denmark, Sweden, &c. 15
" Poland - - - 15
Dunlop's History of Fiction - - 8
Eastlake's History of Oil Painting 8
Eccleston's English Antiquities - 9
Fergus's United States - - - 15
Fergusson On Art - - - - 9
Foss's English Judges - - - 10
Foster's European Literature - 10
Gibbon's Roman Empire - - 10
Grant's Memoir & Correspondence 10
Grattan's Netherlands - - - 15
Grimblot's Wm. III. & Louis XIV. 11
Harrison On the English Language 11
Haydon On Painting and Design - 11
Historical Pictt. of the Middle Ages 12
Humphreys' Black Prince - - 13
Jeffrey's (Lord) Contributions - 14
Keightley's Outlines of History - 15
Kemble's Anglo-Saxons - - 14
Laing's Kings of Norway - - 16
Macaulay's Crit. and Hist. Essays 18
" History of England - 18
Mackintosh's Miscellaneous Works 15
" History of England - 15
M'Culloch's Geographical Dictionary 19
Maunder's Treasury of History - 21
Merivale's History of Rome - - 21
Milner's Church History - - 21
Moore's History of Ireland - - 15
Mosheim's Ecclesiastical History 22
Mure's Ancient Greece - - 22
Nicolas's Chronology of History - 15
Passages from Modern History - 28
Ranke's History of the Reformation 24
Rich's Comp. to Latin Dictionary 24
Riddle's Latin Dictionaries - - 25
Rome, History of - - - - 15
Rowton's British Poetesses - - 25
Russell's Bedford Correspondence 4
Scott's History of Scotland - - 15
Sinnett's Byways of History - - 27
Smith's St. Paul - - - - 28
Soames' Latin Church - - - 28
Southey's The Doctor, &c. - - 28
Stebbing's History of the Church - 15
" History of Reformation 15
Stephen's Church of Scotland - 29
" (Sir T.) Essays - - 29
Switzerland, History of - - - 15
Sydney Smith's Works - - - 28
Taylor's Loyola - - - - 30
Thirlwall's History of Greece - 30
Tooke's History of Prices - - 31
Turner's History of England - 31
Twining's Philosophy of Painting - 31
Zumpt's Latin Grammar - - 32

Juvenile Books.

Amy Herbert - - - - 26
Gertrude - - - - - 26
Howitt's Boy's Country Book - 13
" (Mary) Children's Year - 13
Laneton Parsonage - - - 26
Mrs. Marcet's Conversations - 19 & 20
Margaret Percival - - - - 26
Marryat's Masterman Ready - - 20
" Mission - - - 20
" Settlers in Canada - 20
" Privateer's Man - - 20
Passages from Modern History - 28
Pycroft's English Reading - - 24

Medicine.

	Pages.
Bull's Hints to Mothers	5
“ Management of Children	5
Copland's Dictionary of Medicine	7
Elliotson's Human Physiology	9
Holland's Medical Notes	12
Latham On Diseases of the Heart	16
Pereira On Food and Diet	23
Thomson On Food	30

Miscellaneous.

Allen On Prerogative	3
Cartoons (The Prize)	6
Coad's Memorandum	6
Colton's Lacon	6
De Jaenisch on Chess Openings	7
De la Gravière's Last Naval War	8
De Morgan On Probabilities	15
De Strzelecki's New South Wales	8
Disney's Museum Disneianum	8
Dresden Gallery	8
Dunlop's History of Fiction	8
Graham's English	10
Grant's Letters from the Mountains	10
Hooker's Kew Guide	12
Howitt's Rural Life of England	13
“ Visits to Remarkable Places	13
“ Domestic Life of Germany	13
“ Colonisation & Christianity	13
Jeffrey's (Lord) Contributions	14
Loudon's Lady's Country Comp.	17
Macaulay's Crit. and Hist. Essays	18
Mackintosh's Miscellaneous Works	18
M'Culloch On Succession to Property	20
Maitland's Church in the Catacombs	19
Necker De Saussure On Education	23
Pascal's Works, by Pearce	23
“ Provincial Letters, by do.	23
Plunkett On the British Navy	24
Pycroft's Collegian's Guide	24
“ English Reading	24
Rich's Comp. to Latin Dictionary	24
Richter's Levana	25
Riddle's Latin Dictionaries	25
Rowton's Debater	25
Seaward's Narrative of his Shipwreck	26
Sir Roger de Coverley	27
Smith's (Rev. Sydney) Works	27
Southey's Common-place Book	28
“ The Doctor, &c.	28
Stephen's Essays	29
Suitor's Instructor	29
Thomson On Food	30
Walker's Chess Studies	31
Zumpt's Latin Grammar	32

Natural History.

Catlow's Popular Conchology	6
Doubleday's Butterflies and Moths	8
Gray and Mitchell's Birds	11
Kirby and Spence's Entomology	15
Lee's Taxidermy	16
“ Elements of Natural History	16
Maunder's Natural History	20
Stephens's British Beetles	29
Swainson On Study of Natural Hist.	15
“ Animals	15
“ Taxidermy	15
“ Quadrupeds	15
“ Birds	15
“ Animals in Menageries	15
“ Fish, Amphibia, &c.	15
“ Insects	15
“ Malacology	15
“ Habits and Instincts	15
Turton's Shells of the British Islands	31
Waterton's Essays on Natural Hist.	32
Westwood's Classification of Insects	32

Novels and Works of Fiction.

Dunlop's History of Fiction	8
Eötvös' Village Notary	9
Hall's Midsummer Eve	11
Lady Willoughby's Diary	32
Landor's Fountain of Arethusa	16
Madame De Malguet	19
Marryat's Masterman Ready	20
“ Settlers in Canada	20
“ Mission	20
“ Privateers-man	20
Senior's Charles Vernon	26
Sinclair's Sir Edward Graham	27
Sir Roger de Coverley	27
Sketches (The)	27
Southey's The Doctor, &c.	28
Twelve Years Ago: a Tale	31

1 vol. Cyclopedias & Dictionaries.

	Pages.
Blaine's Rural Sports	4
Brande's Science, Literature, & Art	5
Copland's Dictionary of Medicine	7
Cresy's Civil Engineering	7
Gwilt's Architecture	11
Johnson's Farmer's Encyclopædia	14
Loudon's Agriculture	17
“ Rural Architecture	17
Loudon's Gardening	17
“ Plants	17
“ Trees and Shrubs	17
M'Culloch's Geographical Dictionary	19
“ Dictionary of Commerce	19
Murray's Encyclop. of Geography	22
Ure's Dictionary of Arts, &c.	31
Webster's Domestic Economy	32

Poetry and the Drama.

Aikin's (Dr.) British Poets	3
Chalenor's Walter Gray	6
Flowers and their kindred Thoughts	9
Fruits from Garden and Field	10
Goldsmith's Poems illustrated	10
Gray's Elegy, illuminated	11
Hey's Moral of Flowers	12
“ Sylvan Musings	12
L. E. L.'s Poetical Works	16
Linwood's Anthologia Oxoniensis	17
Macaulay's Lays of Ancient Rome	18
Mackay's English Lakes	18
Montgomery's Poetical Works	21
Moore's Poetical Works	22
“ Lalla Rookh	22
“ Irish Melodies	22
“ Songs and Ballads	22
Rowton's British Poetesses	25
Shakspeare, by Bowdler	26
Songs, Madrigals, and Sonnets	28
Southey's Poetical Works	28
“ British Poets	28
Swain's English Melodies	29
Thomson's Seasons illustrated	30
“ edited by Dr. A. T. Thomson	30

Political Economy & Statistics.

Banfield and Weld's Statistics	3
Gilbart's Treatise on Banking	10
Gray's Tables of Life Contingencies	11
M'Culloch's Geog. Statist. &c. Dict.	19
“ Dictionary of Commerce	19
“ Political Economy	19
“ Statistics of Gt. Britain	19
“ On Funding & Taxation	19
Marcet's Political Economy	19
Tooke's Histories of Prices	31

Religious and Moral Works

	Pages.
Amy Herbert	26
Barrett's Old Testament Criticisms	4
Blakey On Christianity	4
Bloomfield's Greek Testament	4
“ College and School do.	4
“ Lexicon to do.	4
Book of Ruth (illuminated)	5
Bunsen on the Church of the Future	5
Burder's Oriental Customs	5
Burns's Christian Philosophy	5
“ “ Fragments	5
Callcott's Scripture Herbal	6
Conybeare and Howson's St. Paul	6
Cooper's Sermons	7
Coquerel's Christianity	7
Dale's Domestic Liturgy	7
Dibdin's Sunday Library	8
Discipline	8
Ecclesiastes, illuminated	9
Englishman's Greek Concordance	9
Englishman's Heb. & Chald. Concord.	9
Etheridge's Acts and Epistles	9
Forster's Hist. Geography of Arabia	10
From Oxford to Rome	10
Gertrude	26
Hook's Lectures on Passion Week	12
Horne's Introduction to Scriptures	13
“ Abridgment of ditto	14
Jameson's Sacred Legends	14
“ Monastic Legends	14
Jebb's Translation of the Psalms	14
Jeremy Taylor's Works	14
Kip's Christmas in Rome	14
Laneton Parsonage	26
Letters to My Unknown Friends	16
Maitland's Church in the Catacombs	19
“ On Prophecy	19
Margaret Percival	26
Marriage Service (illuminated)	20
Maxims of the Saviour	21
Milner's Church History	21
Miracles of Our Saviour	21
Moore On the Use of the Body	21
“ “ Soul and Body	21
“ 's Man and his Motives	21
Morell's Philosophy of Religion	22
Mosheim's Ecclesiastical History	22
Neale's Closing Scene	23
Parables of Our Lord	23
Parkes's Domestic Duties	23
Rest in the Church	24
Riddle's Letters from a Godfather	25
Sandford's Parochialia	26
“ Female Improvement	26
“ On Woman	26
Sermon on the Mount (The)	26
Shunammite (The Good)	27
Sinclair's Journey of Life	27
“ Business of Life	27
Smith's (G.) Perilous Times	27
“ “ Religion of Anc. Britain	27
“ “ Sacred Annals	27
“ (Sydney) Sermons	27
“ (J.) St. Paul	28
Soames' Latin Church	28
Solomon's Song, illuminated	28
Southey's Life of Wesley	28
Stephen's Church of Scotland	29
Tate's History of St. Paul	29
Tayler's Lady Mary	29
“ Margaret; or, the Pearl	29
“ (Isaac) Loyola	30
Thumb Bible (The)	30
Tomline's Introduction to the Bible	30
Turner's Sacred History	31
Twelve Years Ago	31
Walker's Elementa Liturgica	32
Wardlaw's Socinian Controversy	32
Wilberforce's View of Christianity	32
Wilson's Lands of the Bible	32
Wisdom of Johnson's Rambler, &c.	14
Woodcock's Scripture Lands	32

Rural Sports.

Blaine's Dictionary of Sports	4
Ephemera on Angling	9
Hawbuck Grange	11
Hawker's Instructions to Sportsmen	11
Loudon's Lady's Country Comp.	17
Pocket and the Stud	24
Stable Talk and Table Talk	29
The Stud, for practical purposes	29

The Sciences and Mathematics.

Baker's Railway Engineering	3
Brande's Dictionary of Science, &c.	5
Brewster's Optics	15
Conversations on Mineralogy	6
Cresy's Civil Engineering	7
De la Beche's Geology of Cornwall, &c.	8
Donovan's Chemistry	15
Farey On the Steam Engine	9
Fosbroke On the Ancient Arts, &c.	15
Gower's Scientific Phenomena	10
Herschel's Natural Philosophy	15
“ Astronomy	15
“ Outlines of Astronomy	12
Holland's Manufactures in Metal	15
Humboldt's Aspects of Nature	13
“ Cosmos	13
Hunt's Researches on Light	14
Kane's Chemistry	14
Kater and Lardner's Mechanics	15
Lardner's Cabinet Cyclopædia	15
“ Hydrostatics & Pneumatics	15
“ and Walker's Electricity	15
“ Arithmetic	15
“ Geometry	15
“ Treatise on Heat	15
Low's Chemistry	18
Marcet's (Mrs.) Conversations	19, 20
Matteucci on Physical Phænomena	20
Memoirs of the Geological Survey	21
Moseley's Practical Mechanics	22
“ Engineering & Architecture	22
Owen's Lectures on Comp. Anatomy	23
Peschel's Elements of Physics	23
Phillips's Fossils of Cornwall, &c.	24
“ Mineralogy, by Miller	24
“ Treatise on Geology	15
Portlock's Geology of Londonderry	24
Powell's Natural Philosophy	15
Ritchie On Railways	25
Schleiden's Scientific Botany	26
Steam Engine (The)	3
Thomson's School Chemistry	30

Travels.

Borrer's Algeria	5
Costello's North Wales	7
Coulter's California &c.	7
“ Pacific	7
De Strzelecki's New South Wales	8
Dunlop's Central America	8
Erman's Travels through Siberia	9
Gardiner's Sights in Italy	10
Head's Tour in Rome	12
Humboldt's Aspects of Nature	13
Kip's Holydays in Rome	14
Laing's Tour in Sweden	15
Mackay's English Lakes	18
Marryat's Borneo	20
Mitchell's Australian Expedition	21
Parrot's Ascent of Mount Ararat	23
Power's New Zealand Sketches	24
Seaward's Narrative	26
Von Orlich's Travels in India	31
Wilson's Travels in the Holy Land	32
Woodcock's Scripture Lands	32

Veterinary Medicine, &c.

Pocket and the Stud	24
Stable Talk and Table Talk	29
Stud (The)	29
Thomson On Fattening Cattle	30

NEW WORKS AND NEW EDITIONS,

PUBLISHED BY

MESSRS. LONGMAN, BROWN, GREEN, AND LONGMANS,

PATERNOSTER ROW, LONDON.

ACTON.—MODERN COOKERY,

In all its Branches, reduced to a System of Easy Practice. For the use of Private Families. In a Series of Receipts, all of which have been strictly tested, and are given with the most minute exactness. By ELIZA ACTON. New Edition: with Directions for Carving, and other Additions. Fcp. 8vo. with Plates and Woodcuts, 7s. 6d. cloth.

"The whole of Miss Acton's recipes, 'with a few trifling exceptions, which are scrupulously specified, are confined to such as may be perfectly depended on, from having been proved beneath our own roof, and under our own personal inspection.' We add, moreover, that the recipes are all reasonable, and never in any instance extravagant. They do not bid us sacrifice ten pounds of excellent meat, that we may get a couple of quarts of gravy from it; nor do they deal with butter and eggs as if they cost nothing. Miss Acton's book is a good book in every way; there is right-mindedness in every page of it, as well as thorough knowledge and experience of the subjects she handles."
MEDICAL GAZETTE.

AIKIN.—SELECT WORKS OF THE BRITISH POETS,

From Ben Jonson to Beattie. With Biographical and Critical Prefaces by Dr. AIKIN. New Edition, with Supplement, by LUCY AIKIN; consisting of additional Selections from more recent Poets. 8vo. 18s. cloth.

ALLEN ON THE ROYAL PREROGATIVE.—AN INQUIRY

into the RISE and GROWTH of the ROYAL PREROGATIVE. By the late JOHN ALLEN, Master of Dulwich College. New Edition, with the Author's last corrections: preceded by M. Bérenger's "Rapport" on the Work read before the Institute of France; an Article on the same from the EDINBURGH REVIEW; and a Biographical Notice of the Author. To which is added, an Inquiry into the Life and Character of King Eadwig, from the Author's MS. 8vo. [*Nearly ready.*

ANDERSEN.—THE TRUE STORY OF MY LIFE:

A Sketch. By HANS CHRISTIAN ANDERSEN, Author of "The Shoes of Fortune," "The Nightingale," "O. T.," "Only a Fiddler," "The Improvisatore," &c. Translated by MARY HOWITT. Fcp. 8vo. 5s. cloth.

THE ARTISAN CLUB.—A TREATISE ON THE STEAM

ENGINE, in its Application to Mines, Mills, Steam Navigation, and Railways. By the Artisan Club. Edited by JOHN BOURNE, C.E. New Edition. With 30 Steel Plates and 349 Wood Engravings. 4to. 27s. cloth.

BAKER.—RAILWAY ENGINEERING;

Containing the most approved Methods of laying out Railway Curves, and of setting out the Cuttings, Embankments, and Tunnels of Railways: with a General and two Auxiliary Tables, for the Calculation of Earthworks of Railways, Canals, &c. Also, the Investigation of the Formula for the Superelevation of the exterior Rail in Curves. By T. BAKER, Surveyor and Civil Engineer. 8vo. 5s. cloth.

BALL.—AN ACCOUNT OF THE CULTIVATION AND MANU-

FACTURE of TEA in CHINA: derived from Personal Observation during an Official Residence in that Country of upwards of Twenty years; and illustrated by the best Authorities, Chinese as well as European. With some Remarks on the Experiments now making for the Introduction of the Culture of the Tea Tree in other parts of the World. By S. BALL, Esq., late Inspector of Teas to the East India Company in China. 8vo. with Plates and Woodcuts, 14s. cloth.

BANFIELD AND WELD.—THE STATISTICAL COMPANION;

exhibiting the most interesting Facts in Moral and Intellectual, Vital, Economical, and Political Statistics, at home and abroad. Compiled from Official and other authentic Sources, by T. C. BANFIELD, Statistical Clerk to the Council of Education; and C. R. WELD, Assistant-Secretary to the Royal Society. Fcp. 8vo. 5s. cloth.

BARRETT.—A SYNOPSIS OF CRITICISMS UPON THOSE

PASSAGES of the OLD TESTAMENT in which Modern Commentators have differed from the Authorised Version: together with an Explanation of various Difficulties in the Hebrew and English Texts. By the Rev. RICHARD A. F. BARRETT, M.A. Fellow of King's College, Cambridge. Vols. I. and II. 8vo. 28s. each, cloth; or, in 4 Half-vols. 14s. each. Also, Half-vol. V. 14s. cloth.

BAYLDON.—ART OF VALUING RENTS AND TILLAGES,

And the Tenant's Right of Entering and Quitting Farms, explained by several Specimens of Valuations; and Remarks on the Cultivation pursued on Soils in different Situations. Adapted to the Use of Landlords, Land-Agents, Appraisers, Farmers, and Tenants. By J. S. BAYLDON. New Edition; corrected and revised by John Donaldson. 8vo. 10s. 6d. cloth.

BEDFORD CORRESPONDENCE. — CORRESPONDENCE OF

JOHN, FOURTH DUKE OF BEDFORD, selected from the Originals at Woburn Abbey (1742 to 1770). With Introductions by Lord JOHN RUSSELL. 3 vols. 8vo. with Portrait, 48s. cloth.

BLACK.—A PRACTICAL TREATISE ON BREWING,

Based on Chemical and Economical Principles: with Formulæ for Public Brewers, and Instructions for Private Families. By WILLIAM BLACK, Practical Brewer. New Edition, with considerable Additions. 8vo. 10s. 6d. cloth.

"It is a good many years since we noticed Mr. Black's Treatise, as we have chronicled at intervals its successive editions and their improvements. For the practical purposes of the professional or family brewer, we suppose it is the best book extant."
SPECTATOR.

BLAINE.—AN ENCYCLOPÆDIA OF RURAL SPORTS;

Or, a complete Account, Historical, Practical, and Descriptive, of Hunting, Shooting, Fishing, Racing, and other Field Sports and Athletic Amusements of the present day. By DELABERE P. BLAINE, Esq. Author of "Canine Pathology," &c. Illustrated by nearly 600 Engravings on Wood, by R. Branston, from Drawings by Alken, T. Landseer, Dickes, &c. 8vo. £2. 10s. cloth.

BLAIR'S CHRONOLOGICAL AND HISTORICAL TABLES,

From the Creation to the present time: with Additions and Corrections from the most authentic Writers; including the Computation of St. Paul, as connecting the Period from the Exode to the Temple. Under the revision of Sir HENRY ELLIS, K.H., Principal Librarian of the British Museum. Imperial 8vo. 31s. 6d. half-bound in morocco.

BLAKEY.—THE TEMPORAL BENEFITS OF CHRISTIANITY;

Exemplified in its Influence on the Social, Intellectual and Political Condition of Mankind, from its First Promulgation to the Present Day. By ROBERT BLAKEY, Author of the "History of the Philosophy of Mind," &c. 8vo. 9s. cloth.

BLOOMFIELD.—HISTORY OF THE PELOPONNESIAN WAR.

By THUCYDIDES. A New Recension of the Text, with a carefully amended Punctuation; and copious NOTES, Critical, Philological, and Explanatory, principally original, partly selected and arranged from the best Expositors: accompanied by full Indexes, both of Greek Words and Phrases explained, and matters discussed in the Notes. Illustrated by Maps and Plans. By the Rev. S. T. BLOOMFIELD, D.D. F.S.A. 2 vols. 8vo. 38s. cloth.

BLOOMFIELD.—HISTORY OF THE PELOPONNESIAN WAR.

By THUCYDIDES. Translated into English, and accompanied by very copious Notes, Philological and Explanatory, Historical and Geographical. By the Rev. S. T. BLOOMFIELD, D.D. F.S.A. 3 vols. 8vo. with Maps and Plates, £2. 5s. boards.

BLOOMFIELD.—THE GREEK TESTAMENT:

With copious English Notes, Critical, Philological, and Explanatory. Especially formed for the use of advanced Students and Candidates for Holy Orders. By Rev. S. T. BLOOMFIELD, D.D. F.S.A. New Edition. 2 vols. 8vo. with a Map of Palestine, £2, cloth.

BLOOMFIELD.—COLLEGE & SCHOOL GREEK TESTAMENT:

With shorter English Notes, Critical, Philological, and Explanatory, formed for use in Colleges and the Public Schools. By the Rev. S. T. BLOOMFIELD, D.D. F.S.A. New Edition, greatly enlarged and improved. Fcp. 8vo. 10s. 6d. cloth.

BLOOMFIELD.—GREEK AND ENGLISH LEXICON TO THE

NEW TESTAMENT: especially adapted to the use of Colleges, and the Higher Classes in Public Schools; but also intended as a convenient Manual for Biblical Students in general. By Dr. BLOOMFIELD. New Edition, enlarged and improved. Fcp. 8vo. 10s. 6d. cloth.

THE BOOK OF RUTH.

From the Holy Scriptures. Embellished with brilliant coloured Borders, selected from some of the finest Illuminated MSS. in the British Museum, the Bibliothèque Nationale, Paris, the Soane Museum, &c.; and with highly-finished Miniatures. The Illuminations executed by H. N. Humphreys, Illuminator of "A Record of the Black Prince," &c. Square fcp. 8vo. uniform in size with "Parables of our Lord," &c.; in deeply embossed leather covers.
[*In the Autumn.*

BORRER.—NARRATIVE OF A CAMPAIGN WITH A FRENCH

COLUMN against the KABAÏLES of ALGERIA: with the Mission of M. Suchet to the Emir Abd-el-Kader, for an Exchange of Prisoners. By Dawson Borrer, F.R.G.S. Membre Correspondant de la Société Orientale à Paris; Author of "A Journey from Naples to Jerusalem." Post 8vo. 10s. 6d. boards.

BRANDE.—A DICTIONARY OF SCIENCE, LITERATURE,

AND ART; comprising the History, Description, and Scientific Principles of every Branch of Human Knowledge; with the Derivation and Definition of all the Terms in General Use. Edited by W. T. Brande, F.R.S.L. & E.; assisted by Dr. J. Cauvin. 8vo. with Wood Engravings.
[*New Edition, nearly ready.*

BULL.—HINTS TO MOTHERS,

For the Management of Health during the Period of Pregnancy and in the Lying-in Room: with an Exposure of Popular Errors in connexion with those subjects, &c.; and Hints upon Nursing. By Thomas Bull, M.D. New Edition, carefully revised and enlarged. Fcp. 8vo. 5s. cloth.

BULL.—THE MATERNAL MANAGEMENT OF CHILDREN,

in HEALTH and DISEASE. By T. Bull, M.D. Member of the Royal College of Physicians; formerly Physician-Accoucheur to the Finsbury Midwifery Institution, and Lecturer on Midwifery and on the Diseases of Women and Children. New Edition, carefully revised and enlarged. Fcp. 8vo. 5s. cloth.

BUDGE.—THE PRACTICAL MINER'S GUIDE.

Comprising a Set of Trigonometrical Tables adapted to all the purposes of Oblique or Diagonal, Vertical, Horizontal, and Traverse Dialling; with their application to the Dial, Exercise of Drifts, Lodes, Slides, Levelling, Inaccessible Distances, Heights, &c. By J. Budge. New Edition, considerably enlarged. 8vo. with Portrait of the Author, 12s. cloth.

BUNSEN.—EGYPT'S PLACE IN UNIVERSAL HISTORY:

An Historical Investigation, in Five Books. By Christian C. J. Bunsen, D.Ph. & D.C.L. Translated from the German, by C. H. Cottrell, Esq. M.A.—Vol. I. containing the First Book, or Sources and Primeval Facts of Egyptian History: with an Egyptian Grammar and Dictionary, and a complete List of Hieroglyphical Signs; an Appendix of Authorities, embracing the complete Text of Manetho and Eratosthenes, Ægyptiaca from Pliny, Strabo, &c.; and Plates representing the Egyptian Divinities. 8vo. with numerous illustrations, 28s. cloth.

BUNSEN.—THE CONSTITUTION OF THE CHURCH OF

the FUTURE. A Practical Explanation of the Correspondence with the Right Hon. William Gladstone, on the German Church, Episcopacy, and Jerusalem. With a Preface, Notes, and the complete Correspondence. By the Chevalier C. C. J. Bunsen, Ph. D. D.C.L. Translated under the superintendence of, and with Additions by, the Author. Post 8vo. 9s. 6d. cloth.

BURDER.—ORIENTAL CUSTOMS,

Applied to the Illustration of the Sacred Scriptures. By Dr. Samuel Burder. New Edition, with Additions. Fcp. 8vo. 8s. 6d. cloth.

BURNS.—THE PRINCIPLES OF CHRISTIAN PHILOSOPHY;

containing the Doctrines, Duties, Admonitions, and Consolations of the Christian Religion. By John Burns, M.D. F.R.S. New Edition. Fcp. 8vo. 6s. 6d. cloth.

BURNS.—CHRISTIAN FRAGMENTS;

Or, Remarks on the Nature, Precepts, and Comforts of Religion. By John Burns, M.D. F.R.S. Author of "The Principles of Christian Philosophy." Fcp. 8vo. 5s. cloth.

BUTLER.—A SKETCH OF MODERN AND ANCIENT GEO-

GRAPHY, for the use of Schools. By Samuel Butler, D.D. late Lord Bishop of Lichfield and Coventry; and formerly Head Master of Shrewsbury School. New Edition, revised by the Author's Son. 8vo. 9s. boards.

BUTLER.—A GENERAL ATLAS OF MODERN AND ANCIENT

GEOGRAPHY. By the late Dr. S. Butler. Consisting of Forty-five coloured Maps, and Indices. New Edition, re-engraved; with corrections (in the Modern Maps) from the Government Surveys and other recent sources of information, and (in the Ancient Maps) from the most approved writers on Ancient Geography. 4to. 24s. half-bound.

Separately { The Ancient Atlas. 22 coloured Maps. 8vo. 12s. half-bound.
The Modern Atlas. 23 coloured Maps. 8vo. 12s. half-bound.

THE CABINET LAWYER:

A Popular Digest of the Laws of England, Civil and Criminal; with a Dictionary of Law Terms, Maxims, Statutes, and Judicial Antiquities; Correct Tables of Assessed Taxes, Stamp Duties, Excise Licenses, and Post-Horse Duties; Post-Office Regulations, and Prison Discipline. Fourteenth Edition, enlarged, and corrected throughout, with the Legal Decisions and Statutes to Michaelmas Term, 10 and 11 Victoria. Fcp. 8vo. 10s. 6d. cloth.

CALLCOTT.—A SCRIPTURE HERBAL.

With upwards of 120 Wood Engravings. By Lady Callcott. Square crown 8vo. 25s. cloth.

CARTOONS.—THE PRIZE CARTOONS EXHIBITED

IN WESTMINSTER HALL, A.D. 1843. Published under the Sanction and Patronage of Her Majesty's Commissioners on the Fine Arts. Eleven large folio Engravings, in a neat Portfolio, £5. 5s.; Proofs before Letters, £8. 8s.

CATLOW.—POPULAR CONCHOLOGY;

Or, the Shell Cabinet arranged: being an Introduction to the Modern System of Conchology: with a sketch of the Natural History of the Animals, an account of the Formation of the Shells, and a complete Descriptive List of the Families and Genera. By Agnes Catlow. Fcp. 8vo. with 312 Woodcuts, 10s. 6d. cloth.

CHALENOR.—WALTER GRAY,

A Ballad, and other Poems. By Mary Chalenor. New Edition, including the Author's Poetical Remains. Fcp. 8vo. 6s. cloth.

COAD.—A MEMORANDUM OF THE WONDERFUL PRO-

VIDENCES of GOD to a POOR UNWORTHY CREATURE (from 12th of June 1685 unto the 24th of November 1690) on and after the Revolution betweene the Duke of Monmouth and King James. By John Coad. Square fcp. 8vo. [*Nearly ready.*

> "The best account of the sufferings of those rebels who were sentenced to transportation is to be found in a very curious narrative written by John Coad, an honest Godfearing carpenter, who joined Monmouth, was badly wounded at Philip's Norton, was tried by Jeffreys, and was sent to Jamaica. The original manuscript was kindly lent to me by Mr. Phippard, to whom it belongs." . Macaulay's *England*, vol. i. p. 647 (note).

⁂ This work is printed, by permission of Mr. Phippard, from the MS. referred to in the above note by Mr. Macaulay.

COLLINS. — MEMOIRS OF THE LIFE OF WILLIAM

COLLINS, Esq. R.A. Including Selections from his Journals and Correspondence, Notices of many of his eminent Contemporaries, and a Description of his principal Works. By his Son, W, Wilkie Collins, Esq. With Portrait after Linnell, and 2 Vignettes from Sketches by the Painter. 2 vols. post 8vo. 21s. cloth.

COLTON.—LACON; OR, MANY THINGS IN FEW WORDS.

By the Rev. C. C. Colton. New Edition. 8vo. 12s. cloth.

CONYBEARE AND HOWSON.—THE LIFE AND EPISTLES

of SAINT PAUL; comprising a complete Biography of the Apostle, and a Paraphrastic Translation of his Epistles inserted in Chronological Order. Edited by the Rev. W. J. Conybeare, M.A. late Fellow of Trinity College, Cambridge; and the Rev. J. S. Howson, M.A. late Principal of the Collegiate Institution, Liverpool. 2 vols. 4to. richly illustrated by numerous Engravings on Steel and Wood of the Principal Places visited by the Apostle, from Original Drawings made on the spot by W. H. Bartlett; and by Maps, Charts, Coins, &c.

⁂ To be published in Monthly Parts, price 2s. each; the First of which will appear *on January 1st*, 1850.

CONVERSATIONS ON BOTANY.

New Edition, improved. Fcp. 8vo. 22 Plates, 7s. 6d. cloth; with the plates coloured, 12s. cloth.

CONVERSATIONS ON MINERALOGY.

With Plates, engraved by Mr. and Mrs. Lowry, from Original Drawings. New Edition, enlarged. 2 vols. fcp. 8vo. 14s. cloth.

COOPER.—PRACTICAL AND FAMILIAR SERMONS,

Designed for Parochial and Domestic Instruction. By Rev. Edward Cooper. New Edition. 7 vols. 12mo. £1. 18s. boards.

COOPER.—SERMONS,

Chiefly designed to elucidate some of the leading Doctrines of the Gospel. By the Rev. Edward Cooper. New Edition. 2 vols. 12mo. 10s. boards.

COPLAND.—A DICTIONARY OF PRACTICAL MEDICINE;

comprising General Pathology, the Nature and Treatment of Diseases, Morbid Structures, and the Disorders especially incidental to Climates, to Sex, and to the different Epochs of Life; with numerous approved Formulæ of the Medicines recommended. By James Copland, M.D. Consulting Physician to Queen Charlotte's Lying-in Hospital, &c. &c. Vols. I. and II. 8vo. £3, cloth; and Parts X. to XIV. 4s 6d. each, sewed.

COQUEREL.—CHRISTIANITY;

Its perfect adaptation to the Mental, Moral, and Spiritual Nature of Man. By Athanase Coquerel, one of the Pastors of the French Protestant Church in Paris. Translated by the Rev. D. Davison, M.A. With an Introductory Notice of the State of the Protestant Church of France, drawn up by the Author especially for the English Edition. Post 8vo. 12s. cloth.

COSTELLO.—THE FALLS, LAKES, AND MOUNTAINS

OF NORTH WALES; being a Pictorial Tour through the most interesting parts of the Country. By Miss Louisa Stuart Costello. Illustrated with Views, from Original Sketches by D. H. M'Kewan, engraved on wood, and lithographed, by T. and E. Gilks. Square 8vo. with Map, 14s. cloth.

COULTER.—ADVENTURES ON THE WESTERN COAST OF

SOUTH AMERICA and in the INTERIOR of CALIFORNIA; including a Narrative of Incidents at the Kingsmill Islands, New Ireland, New Britain, New Guinea, and other Islands in the Pacific Ocean: with an Account of the Natural Productions, and the Manners and Customs, in Peace and War, of the various Savage Tribes visited. By John Coulter, M.D. Author of "Adventures in the Pacific." 2 vols. post 8vo. 16s. cloth.

COULTER.—ADVENTURES IN THE PACIFIC:

With Observations on the Natural Productions, Manners, and Customs of the Natives of the various Islands; Remarks on the Missionaries, British and other Residents, &c. By John Coulter, M.D. Post 8vo. 7s. 6d. cloth.

CRESY.—AN ENCYCLOPÆDIA OF CIVIL ENGINEERING,

Historical, Theoretical, and Practical. By Edward Cresy, F.S.A. C.E. Illustrated by upwards of Three Thousand Engravings on Wood, explanatory of the Principles, Machinery, and Constructions which come under the Direction of the Civil Engineer. One very large Volume 8vo. £3. 13s. 6d. cloth.

CROCKER'S ELEMENTS OF LAND SURVEYING.

New Edition, corrected throughout, and considerably improved and modernized, by T. G. Bunt, Land Surveyor. To which are added, TABLES OF SIX-FIGURE LOGARITHMS, &c., superintended by R. Farley, of the Nautical Almanac Establishment. Post 8vo. 12s. cloth.

D'AGINCOURT.—THE HISTORY OF ART, BY ITS MONUMENTS,

from its Decline in the Fourth Century to its Restoration in the Sixteenth. Translated from the French of Seroux D'Agincourt, by Owen Jones, Architect. In 3,335 Subjects, engraved on 328 Plates. Vol. I. Architecture, 73 Plates; Vol. II. Sculpture, 51 Plates; Vol. III. Painting, 204 Plates. 3 vols. royal folio, £5. 5s. sewed.

DALE.—THE DOMESTIC LITURGY AND FAMILY CHAPLAIN,

in two Parts: the First Part being Church Services adapted for domestic use, with Prayers for every day of the week, selected exclusively from the Book of Common Prayer; Part II. comprising an appropriate Sermon for every Sunday in the year. By the Rev. Thomas Dale, M.A., Vicar of St. Pancras. Post 4to., 21s. cloth: or, bound by Hayday, 31s. 6d. calf lettered; £2. 10s. morocco.

DE JAENISCH & WALKER.—DE JAENISCH'S CHESS PRECEPTOR:

A New Analysis of the Openings of Games. By C. F. De Jaenisch, of St. Petersburgh. Translated from the French, with copious Notes, by George Walker, Author of "Chess Studies," and various other Works on the Game of Chess. 8vo. 15s. cloth.

DE LA BECHE.—REPORT ON THE GEOLOGY OF CORNWALL, DEVON, and WEST SOMERSET.

By HENRY T. DE LA BECHE, F.R.S. &c., Director of the Ordnance Geological Survey. Published by Order of the Lords Commissioners of H.M. Treasury. 8vo. with Maps, Woodcuts, and 12 large Pates, 14s. cloth.

DE LA GRAVIERE.—SKETCHES OF THE LAST NAVAL WAR.

Translated from the French of Capt. E. JURIEN de la GRAVIERE, with an Introduction and Notes, by the Hon. Capt. PLUNKETT, R.N. Author of "The Past and Future of the British Navy." 2 vols. post 8vo. with 9 Plans of Naval Actions, 18s. cloth.

DE STRZELECKI.—THE PHYSICAL DESCRIPTION OF NEW SOUTH WALES and VAN DIEMAN'S LAND;

accompanied by a Geological Map Sections, and Diagrams, and Figures of the Organic Remains. By P. E. DE STRZELECKI. 8vo. with coloured Map and numerous Plates, 24s. cloth.

DIBDIN.—THE SUNDAY LIBRARY:

Containing nearly One Hundred Sermons, by eminent Divines. With Notes, &c. by the Rev. T. F. DIBDIN, D.D. 6 vols. fcp. 8vo. with Six Portraits, 30s. cloth; or, £2. 12s. 6d. neatly half-bound in morocco, with gilt edges.

DISCIPLINE.

By the Author of "Letters to my Unknown Friends," "Twelve Years Ago," and "Some Passages from Modern History." 18mo. 2s. cloth.

DISNEY.—MUSEUM DISNEIANUM:

Being a Description of a Collection of Ancient Marbles, Bronzes, and various other Specimens of Ancient Art, in the possession of JOHN DISNEY, Esq. F.R.S. F.S.A. at the Hyde, near Ingatestone. With numerous Plates and Wood Engravings. 1 vol. 4to. comprising 120 Illustrations, £4. 14s. 6d. cloth.

CONTENTS.

Part I. Marbles. Comprising Fifty-nine Plates, chiefly Busts, with some whole-length Statues, and some Bas-reliefs.

Part II. Miscellaneous Antiquities, chiefly in Bronze. Comprising Five Statues, many Lamps, Tripods, Patinæ, &c.

Part III. Vases and Fictilia.—Sold separately, only to the purchasers of the First and Second Parts, £2. 2s. cloth.

DOUBLEDAY AND HEWITSON'S BUTTERFLIES. — THE GENERA of BUTTERFLIES, or DIURNAL LEPIDOPTERA;

comprising their Generic Characters—a Notice of the Habits and Transformations—and a Catalogue of the Species of each Genus. By EDWARD DOUBLEDAY, Esq. F.L.S. &c., Assistant in the Zoological Department of the British Museum. Imperial 4to. uniform with Gray and Mitchell's Ornithology; Illustrated with 75 Coloured Plates, by W. C. HEWITSON, Esq. Author of "British Oology."

⁂ Publishing in Monthly Parts, 5s. each; each part consisting of 2 coloured plates, with Letter-press giving the Generic Characters, a Short Notice of the Habits, and a Catalogue of the Species of each Genus. To be completed in about 40 Parts, of which 31 are now ready.

DRESDEN GALLERY.—THE MOST CELEBRATED PICTURES of the ROYAL GALLERY at DRESDEN,

drawn on Stone, from the Originals, by Franz Hanfstaengl: with Descriptive and Biographical Notices, in French and German. Nos. I. to LIV. imperial folio, each containing 3 Plates, with Letter-press, price 20s. to Subscribers; to Non Subscribers, 30s. Single Plates, 12s. each.

⁂ To be completed in 6 more numbers, price 20s. each, to Subscribers. Nos. LI. to LX. contain each *Four Plates* and Letterpress.

DUNLOP.—TRAVELS IN CENTRAL AMERICA.

With a Journal of nearly Three Years' Residence in the Country. To which are added, a Sketch of the History of the Republic, and an Account of its Climate, Productions, Commerce, &c. By ROBERT GLASGOW DUNLOP, Esq. Post 8vo. with Map, 10s. 6d. cloth.

DUNLOP.—THE HISTORY OF FICTION:

Being a Critical Account of the most celebrated Prose Works of Fiction, from the earliest Greek Romances to the Novels of the Present Age. By JOHN DUNLOP, Esq. New Edition, complete in One Volume. 8vo. 15s. cloth.

EASTLAKE. — MATERIALS FOR A HISTORY OF OIL PAINTING.

By CHARLES LOCK EASTLAKE, Esq. R.A. F.R.S. F.S.A.; Secretary to the Royal Commission for Promoting the Fine Arts in connexion with the rebuilding of the Houses of Parliament, &c. 8vo. 16s. cloth.

⁂ Vol. II. On the Italian Practice of Oil Painting, is *preparing for publication*.

ECCLESIASTES; OR, THE PREACHER.

The Words of the Preacher, Son of David, King of Jerusalem. From the Holy Scriptures. Being the Twelve Chapters of the Book of Ecclesiastes, elegantly illuminated, in the Missal Style, by Owen Jones. Imperial 8vo. in very massive carved covers, 42s.; or handsomely bound in morocco, 50s.

ECCLESTON.—AN INTRODUCTION TO ENGLISH ANTIQUITIES.

Intended as a Companion to the History of England. By James Eccleston, B.A. Head Master of Sutton Coldfield Grammar School. 8vo. with numerous Engravings on Wood, 21s. cloth.

ELLIOTSON.—HUMAN PHYSIOLOGY:

With which is incorporated much of the elementary part of the "Institutiones Physiologicæ" of J F. Blumenbach, Professor in the University of Göttingen. By John Elliotson, M.D. Cantab. F.R.S. Fifth Edition. 8vo. with numerous Woodcuts, £2. 2s. cloth.

THE ENGLISHMAN'S GREEK CONCORDANCE OF THE NEW TESTAMENT:

being an Attempt at a Verbal Connexion between the Greek and the English Texts; including a Concordance to the Proper Names, with Indexes, Greek-English and English-Greek. New Edition, with a new Index. Royal 8vo. 42s. cloth.

THE ENGLISHMAN'S HEBREW AND CHALDEE CONCORDANCE of the OLD TESTAMENT;

being an attempt at a Verbal Connection between the Original and the English Translations: with Indexes, a List of the Proper Names and their occurrences, &c. 2 vols. royal 8vo. £3. 13s. 6d. cloth; large paper, £4. 14s. 6d.

EÖTVÖS.—THE VILLAGE NOTARY:

A Romance of Hungarian Life. Translated from the Hungarian of Baron Eötvös, by Otto Wenckstern. With Introductory Remarks, written expressly for the present Translation, by Francis Pulszky. 3 vols. post 8vo. [*Nearly ready.*

EPHEMERA.—A HAND-BOOK OF ANGLING;

Teaching Fly-fishing, Trolling, Bottom-fishing, Salmon-fishing; with the Natural History of River Fish, and the best modes of Catching them. By Ephemera, of "Bell's Life in London." New Edition, enlarged. Fcp. 8vo. with numerous Woodcuts, 9s. cloth.

ERMAN.—TRAVELS IN SIBERIA:

including Excursions northwards, down the Obi, to the Polar Circle, and southwards to the Chinese Frontier. By Adolph Erman. Translated by W. D. Cooley, Esq. Author of "The History of Maritime and Inland Discovery;" Translator and Editor of Parrot's "Journey to Ararat." 2 vols. 8vo. with Map, 31s. 6d. cloth.

ETHERIDGE.—THE APOSTOLICAL ACTS AND EPISTLES,

From the Peschito, or Ancient Syriac. To which are added, the remaining Epistles, and the Book of Revelation, after a later Syrian Text. Translated, with Prolegomena and Indices, by J. W. Etheridge, M.A. Doctor in Philosophy of the University of Heidelberg, and Member of the Asiatic Society of Paris. Royal 12mo. 7s. 6d. cloth.

EVANS.—THE SUGAR PLANTER'S MANUAL:

Being a Treatise on the Art of obtaining Sugar from the Sugar Cane. By W. J. Evans, M.D. 8vo. 9s. cloth.

FAREY.—A TREATISE ON THE STEAM ENGINE,

Historical, Practical, and Descriptive. By John Farey, Engineer. 4to. with 25 Plates, and numerous Woodcuts, £5. 5s. boards.

FERGUSSON.—AN HISTORICAL INQUIRY INTO THE TRUE PRINCIPLES of BEAUTY in ART,

more especially with reference to ARCHITECTURE. By James Fergusson, Esq.; Author of "An Essay on the Ancient Topography of Jerusalem," "Picturesque Illustrations of Ancient Architecture in Hindostan," &c. With 5 Copperplates, a coloured Lithographic Engraving, and upwards of 100 Woodcuts. Imperial 8vo. 30s. cloth.

FLOWERS AND THEIR KINDRED THOUGHTS:

A Series of Stanzas—On Hope, Innocence, Modesty, Childhood, Humility, Joy, Love, Constancy, Fascination, Timidity, Fine Taste, Thoughts, Recollection, and Friendship. By Mary Anne Bacon. Illustrated by the Snowdrop, Primrose, Violet, Harebell, and Pimpernel, Lilley of the Valley, Hawthorn, Rose, Honeysuckle, Carnation, Convolvulus, Fuchsia, Pansy, Forget-me-not, and Holly; designed and printed in Colours by Owen Jones. Imperial 8vo. 31s. 6d. elegantly bound.

FORSTER.—THE HISTORICAL GEOGRAPHY OF ARABIA;

or, the Patriarchal Evidences of Revealed Religion. A Memoir, with illustrative Maps and an Appendix, containing Translations, with an Alphabet and Glossary of the Hamyaritic Inscriptions recently discovered in Hadramant. By the Rev. CHARLES FORSTER, Author of "Mahometanism Unveiled." 2 vols. 8vo. 30s. cloth.

FOSS.—THE JUDGES OF ENGLAND:

with Sketches of their Lives, and Miscellaneous Notices connected with the Courts at Westminster from the time of the Conquest. By EDWARD FOSS, F.S.A. of the Inner Temple. Vols. I. and II. 8vo. 28s. cloth.

FOSTER.—A HANDBOOK OF MODERN EUROPEAN LITERATURE:

British, Danish, Dutch, French, German, Hungarian, Italian, Polish and Russian, Portuguese, Spanish, and Swedish. With a full Biographical and Chronological Index. By Mrs. FOSTER. Fcp. 8vo. 8s. 6d. cloth.

⁂ The object of this book is, not so much to give elaborate criticisms on the various writers in the language to whose literature it is intended as a guide, as to direct the student to the best writers in each, and to inform him on what subjects they have written.

FROM OXFORD TO ROME;

And, How it fared with some who lately made the Journey. By a COMPANION TRAVELLER. New Edition, revised and corrected. Fcp. 8vo. with Frontispiece, 6s. cloth.

FRUITS FROM THE GARDEN AND THE FIELD.

A Series of Stanzas. By MARY ANNE BACON, Author of "Flowers and their kindred Thoughts." With beautiful Illustrations of Fruit, designed and printed in Colours by Owen Jones. Imp. 8vo. uniform with "Flowers and their kindred Thoughts," 31s. 6d. [*Nearly ready.*

GARDINER.—SIGHTS IN ITALY:

With some Account of the Present State of Music and the Sister Arts in that Country. By WILLIAM GARDINER, Author of "Sacred Melodies," "Music of Nature," &c.; Member of the Academy of St. Cecilia, Rome; and of the Class of Fine Arts de l'Institut Historique de France. 8vo. with engraved Music, 16s. cloth.

GIBBON'S HISTORY OF THE DECLINE AND FALL OF THE ROMAN EMPIRE.

A new Edition, complete in One Volume. With an Account of the Author's Life and Writings, by ALEXANDER CHALMERS, Esq. F.A.S. 8vo. with Portrait, 18s. cloth.

⁂ An Edition, in 8 vols. 8vo. 60s. boards.

GILBART.—A PRACTICAL TREATISE ON BANKING.

By JAMES WILLIAM GILBART, F.R.S. General Manager of the London and Westminster Bank. 5th Edition, with Portrait of the Author, and View of the "London and Westminster Bank," Lothbury. 2 vols. 8vo. 24s. cloth.

GOLDSMITH.—THE POETICAL WORKS OF OLIVER GOLDSMITH.

Illustrated by Wood Engravings, from Designs by Members of the Etching Club. With a Biographical Memoir, and Notes on the Poems. Edited by BOLTON CORNEY, Esq. Square crown 8vo. uniform with "Thomson's Seasons," 21s. cloth; or, bound in morocco, by Hayday, £1. 16s.

GOWER.—THE SCIENTIFIC PHÆNOMENA OF DOMESTIC LIFE,

familiarly explained. By CHARLES FOOTE GOWER. New Edition. Fcp. 8vo. with Wood Engravings, 5s. cloth.

GRAHAM.—ENGLISH; OR, THE ART OF COMPOSITION:

explained in a Series of Instructions and Examples. By G. F. GRAHAM. New Edition, revised and improved. Fcp. 8vo. 6s. cloth.

GRANT.—LETTERS FROM THE MOUNTAINS.

Being the Correspondence with her Friends, between the years 1773 and 1803. By Mrs GRANT, of Laggan. New Edition. Edited, with Notes and Additions, by her son, J. P. GRANT, Esq. 2 vols. post 8vo. 21s. cloth.

GRANT.—MEMOIR AND CORRESPONDENCE OF THE

late Mrs. Grant, of Laggan, Author of "Letters from the Mountains," "Memoirs of an American Lady," &c. Edited by her Son, J. P. GRANT, Esq. New Edition. 3 vols. post 8vo. with Portrait, 31s. 6d. cloth.

GRAY'S ELEGY (ILLUMINATED).

GRAY'S ELEGY, WRITTEN IN A COUNTRY CHURCHYARD. Illuminated, in the Missal style, by **OWEN JONES**, Architect. Imperial 8vo. 31s. 6d. elegantly bound.

GRAY.—TABLES AND FORMULÆ FOR THE COMPUTATION

of LIFE CONTINGENCIES; with copious Examples of Annuity, Assurance, and Friendly Society Calculations. By **PETER GRAY**, F.R.A.S. Associate of the Institute of Actuaries of Great Britain and Ireland. Royal 8vo. 15s. cloth.

GRAY AND MITCHELL'S ORNITHOLOGY.—THE GENERA

Of BIRDS; comprising their Generic Characters, a Notice of the Habits of each Genus, and an extensive List of Species, referred to their several Genera. By **GEORGE ROBERT GRAY**, Acad. Imp. Georg. Florent. Soc. Corresp. Senior Assistant of the Zoological Department, British Museum; and Author of the "List of the Genera of Birds," &c. 3 vols. imperial 4to. illustrated with 350 coloured and plain Plates, by **DAVID WILLIAM MITCHELL**.

⁂ Parts I. to XLIX. imperial 4to. 10s. 6d. each.—Part L., with Title, Indexes, Tables, &c. completing the work, in 3 vols., is *nearly ready*.

GRIMBLOT.—LETTERS OF WILLIAM III. AND LOUIS XIV.

and of their Ministers. Illustrating the Domestic and Foreign Politics of England from the Peace of Ryswick to the Accession of Philip V. of Spain (1697 to 1770). Edited by **PAUL GRIMBLOT**. 2 vols. 8vo. 30s. cloth.

GWILT.—AN ENCYCLOPÆDIA OF ARCHITECTURE;

Historical, Theoretical, and Practical. By **JOSEPH GWILT**, Esq. F.S.A. Illustrated with upwards of 1,000 Engravings on Wood, from Designs by **J. S. GWILT**. 8vo. 52s. 6d. cloth.

SIDNEY HALL'S NEW GENERAL LARGE LIBRARY ATLAS

OF FIFTY-THREE MAPS (size 20 in. by 16 in.), with the Divisions and Boundaries carefully coloured; and an Alphabetical Index of all the Names contained in the Maps, with their Latitude and Longitude. An entirely New Edition, corrected throughout from the best and most recent Authorities; with all the Railways laid down, and many of the Maps re-drawn and re-engraved. Colombier 4to. £5. 5s. half-bound in russia.

"This is one of the very best of the larger collections of maps with which we are acquainted, for clearness and accuracy, as well as its very reasonable cost. Several striking improvements characterise the edition before us. It has again undergone comparison with the best authorities, contains many corrections consequent on the latest Government surveys, supplies all the varions lines of railway neatly laid down, gives quite new maps where necessary, and is enriched with an alphabetical index of more than *seventy thousand* names of places contained in the collection, with their degrees of latitude and longitude. This index, which is quite invaluable, is printed with exquisite clearness; and we have examined a sufficient number of names and places to be convinced of its general and faultless accuracy. Of Maps, it has been properly said that they are works always in progress. They can never be considered as finished, because they unceasingly wait corrections to be supplied by the science and enterprise of succeeding ages. A glance at the beautiful volume before us, and the most cursory comparison of it with the best collections at the opening of the present century, will shew us the astounding rapidity with which, in such matters, both enterprise and science have advanced of late, and the more than equal pace that is kept with both by all whose duty it is to popularise and make accessible their results. Such a book as this could as little have been placed within the reach of moderate means half a century ago, as the information it contains could have been even guessed at."—EXAMINER.

HALL.—MIDSUMMER EVE:

A Fairy Tale of Love. By Mrs. **S. C. HALL**. With nearly 300 Wood Engravings from Designs by D. Maclise, C. Stanfield, T. Creswick, T. Landseer, and other eminent Artists. Square crown 8vo. 21s. cloth.

HARRISON.—ON THE RISE, PROGRESS, AND PRESENT

STRUCTURE of the ENGLISH LANGUAGE. By the Rev. **M. HARRISON**, M.A. late Fellow of Queen's College, Oxford. Post 8vo. 8s. 6d. cloth.

"An able, enlightened, and philosophical work. From the erudite and scholarly manner in which the author has treated the subject, he has contrived to make his work not only excellent for the special purpose for which it is intended, but, from the mass of curious information which it contains, really interesting to all classes of readers."—SUNDAY TIMES.

HAWBUCK GRANGE;

Or, the Sporting Adventures of Thomas Scott, Esq. By the Author of "Handley Cross; or, the Spa Hunt." With Eight Illustrations by Phiz. 8vo. 12s. cloth.

HAWKER.—INSTRUCTIONS TO YOUNG SPORTSMEN

In all that relates to Guns and Shooting. By Lieut.-Col. **P. HAWKER**. New Edition, corrected, enlarged, and improved; with Eighty-five Plates and Woodcuts by Adlard and Branston, from Drawings by C. Varley, Dickes, &c. 8vo. 21s. cloth.

HAYDON.—LECTURES ON PAINTING AND DESIGN:

Delivered at the London Institution, the Royal Institution, Albemarle Street, to the University of Oxford, &c. By **B. R. HAYDON**, Historical Painter. With Portraits of the Author and of Sir David Wilkie, and Wood Engravings, from Designs by the Author. 2 vols. 8vo. 24s. cloth.

SIR GEORGE HEAD.—ROME:

A Tour of Many Days. By Sir George Head. 3 vols. 8vo. 36s. cloth.

"The roads, the streets, the palaces, the churches, the fountains, the public buildings, and the private houses of any note, the baths, the fortifications, the arches, the cemeteries, the walls, the villas, the temples, the monuments, the theatres, the forums, the ruins, and the relics of every kind, and the inhabitants also, are all set before us in the best possible order. In short, it is a standard work, to last like Rome!" LITERARY GAZETTE.

SIR JOHN HERSCHEL.—OUTLINES OF ASTRONOMY.

By Sir John F. W. Herschel, Bart. &c. &c. &c. 8vo. with Plates and Woodcuts, 18s.

"We take our leave of this remarkable work, which we hold to be, beyond a doubt, the most remarkable of the works in which the laws of astronomy and the appearances of the heavens are described to those who are not mathematicians nor observers, and recalled to those who are." ATHENÆUM.

MRS. HEY.—THE MORAL OF FLOWERS;

Or, Thoughts gathered from the Field and the Garden. By Mrs. Hey. Being a New Edition of "The Moral of Flowers;" and consisting of Poetical Thoughts on Garden and Field Flowers, accompanied by Drawings beautifully coloured after Nature. Square crown 8vo. uniform in size with "Thomson's Seasons illustrated by the Etching Club," 21s. cloth.

MRS. HEY.—SYLVAN MUSINGS;

Or, the Spirit of the Woods. By Mrs. Hey. Being a New Edition of the "Spirit of the Woods;" and consisting of Poetical Thoughts on Forest Trees, accompanied by Drawings of Blossoms and Foliage, beautifully coloured after Nature. Square crown 8vo. uniform in size with "Thomson's Seasons illustrated by the Etching Club," 21s. cloth.

HINTS ON ETIQUETTE AND THE USAGES OF SOCIETY:

With a Glance at Bad Habits. By Αγωγός. "Manners make the man." New Edition, revised (with additions) by a Lady of Rank. Fcp. 8vo. 2s. 6d. cloth.

HISTORICAL PICTURES OF THE MIDDLE AGES,

In Black and White. Made on the spot, from Records in the Archives of Switzerland. By a Wandering Artist. 2 vols. post 8vo. 18s. cloth.

HOARE.—A PRACTICAL TREATISE ON THE CULTIVATION

OF THE GRAPE VINE ON OPEN WALLS. By Clement Hoare. New Edition. 8vo. 7s. 6d. cloth.

HOARE.—A DESCRIPTIVE ACCOUNT OF A NEW METHOD

of PLANTING and MANAGING the ROOTS of GRAPE VINES. By Clement Hoare, Author of "A Treatise on the Cultivation of the Grape Vine on Open Walls." 12mo. 5s. cloth.

HOLLAND.—MEDICAL NOTES AND REFLECTIONS.

By Henry Holland, M.D. F.R.S. &c. Fellow of the Royal College of Physicians, Physician Extraordinary to the Queen, and Physician in Ordinary to His Royal Highness Prince Albert. New Edition. 8vo. 18s. cloth.

HOOK.—THE LAST DAYS OF OUR LORD'S MINISTRY:

A Course of Lectures on the principal Events of Passion Week. By Walter Farquhar Hook, D.D. Vicar of Leeds, Prebendary of Lincoln, and Chaplain in Ordinary to the Queen. New Edition. Fcp. 8vo. 6s. cloth.

HOOKER.—KEW GARDENS;

Or, a Popular Guide to the Royal Botanic Gardens of Kew. By Sir William Jackson Hooker, K.H. D.C.L. F.R.A. & L.S. &c. &c. Director. New Edition. 16mo. with numerous Wood Engravings, 6d. sewed.

HOOKER.—THE BRITISH FLORA,

In Two Vols. Vol. I.; comprising Phænogamous or Flowering Plants, and the Ferns. By Sir William Jackson Hooker, K.H. LL.D. F.R.A. and L.S. &c. &c &c. New Edition, with Additions and Corrections; and 173 Figures illustrative of the Umbelliferous Plants, the Composite Plants, the Grasses, and the Ferns. 8vo. with 12 Plates, 14s. plain; with the Plates coloured, 24s. cloth.

Vol. II. in Two Parts, comprising the Cryptogamia and Fungi. 8vo. 24s. cloth.

HORNE.—AN INTRODUCTION TO THE CRITICAL STUDY

and KNOWLEDGE of the HOLY SCRIPTURES. By Thomas Hartwell Horne, B.D. of St. John's College, Cambridge; Rector of the united Parishes of St. Edmund the King and Martyr, and St. Nicholas Acons, Lombard Street; Prebendary of St. Paul's. New Edition, revised and corrected. 5 vols. 8vo. with numerous Maps and Facsimiles of Biblical Manuscripts, 63s. cloth; or £5, bound in calf.

HORNE.—A COMPENDIOUS INTRODUCTION TO THE

STUDY of the BIBLE. By THOMAS HARTWELL HORNE, B.D. of St. John's College, Cambridge. Being an Analysis of his "Introduction to the Critical Study and Knowledge of the Holy Scriptures." New Edition, corrected and enlarged. 12mo. with Maps and other Engravings, 9s. boards.

HOWITT.—THE CHILDREN'S YEAR.

By MARY HOWITT. With Four Illustrations, engraved by John Absolon, from Original Designs by ANNA MARY HOWITT. Square 16mo. 5s. cloth.

HOWITT.—THE BOY'S COUNTRY BOOK:

Being the real Life of a Country Boy, written by himself; exhibiting all the Amusements, Pleasures, and Pursuits of Children in the Country. Edited by WILLIAM HOWITT. New Edition. Fcp. 8vo. with 40 Woodcuts, 6s. cloth.

HOWITT.—THE RURAL LIFE OF ENGLAND.

By WILLIAM HOWITT. New Edition, corrected and revised. Medium 8vo. with Engravings on wood, by Bewick and Williams, uniform with "Visits to Remarkable Places," 21s. cloth.

HOWITT.—VISITS TO REMARKABLE PLACES;

Old Halls, Battle-Fields, and Scenes illustrative of Striking Passages in English History and Poetry. By WILLIAM HOWITT. New Edition. Medium 8vo. with 40 Engravings on Wood, 21s. cloth.

SECOND SERIES, chiefly in the Counties of NORTHUMBERLAND and DURHAM, with a Stroll along the BORDER. Medium 8vo. with upwards of 40 Engravings on Wood, 21s. cloth.

HOWITT.—THE RURAL AND SOCIAL LIFE OF GERMANY:

With Characteristic Sketches of its Chief Cities and Scenery. Collected in a General Tour, and during a Residence in that Country. By WILLIAM HOWITT. Medium 8vo. with 50 Engravings on Wood, 21s. cloth.

HOWITT.—COLONISATION AND CHRISTIANITY:

A Popular History of the Treatment of the Natives, in all their Colonies, by the Europeans. By WILLIAM HOWITT. Post 8vo. 10s. 6d. cloth.

HOWSON AND CONYBEARE.—THE LIFE AND EPISTLES

of SAINT PAUL. By the Rev. J. S. HOWSON, M.A., and the Rev. W. J. CONYBEARE, M.A. 2 vols. 4to. richly illustrated. [*See page* 6.

HUDSON.—THE EXECUTOR'S GUIDE.

By J. C. HUDSON, Esq. late of the Legacy Duty Office, London; Author of "Plain Directions for Making Wills," and "The Parent's Hand-book." New Edition. Fcp. 8vo. 5s. cloth.

HUDSON.—PLAIN DIRECTIONS FOR MAKING WILLS

In Conformity with the Law, and particularly with reference to the Act 7 Will. 4 and 1 Vict. c. 26. To which is added, a clear Exposition of the Law relating to the distribution of Personal Estate in the case of Intestacy; with two Forms of Wills, and much useful information, &c. By J. C. HUDSON, Esq. New Edition, corrected. Fcp. 8vo. 2s. 6d. cloth.

⁂ These two works may be had in one volume, 7s. cloth.

HUMBOLDT.—ASPECTS OF NATURE,

in Different Lands and in Different Climates. By ALEXANDER VON HUMBOLDT. Translated, with the Author's sanction and co-operation, and at his express desire, by Mrs. SABINE. 2 vols. 16mo. uniform with Murray's "Home and Colonial Library."

BARON VON HUMBOLDT'S COSMOS;

Or, a Sketch of a Physical Description of the Universe. Translated, with the Author's sanction and co-operation, under the superintendence of Lieutenant-Colonel EDWARD SABINE, R.A. For. Sec. R.S. New Edition. 16mo. uniform with Mr. Murray's "Home and Colonial Library." Vols. I. and II. price Half-a-Crown each.

⁂ The authorised "Library Edition," in post 8vo., Vols. I. and II. price 12s. each, may still be had.

HUMPHREYS.—A RECORD OF THE BLACK PRINCE;

being a Selection of such Passages in his Life as have been most quaintly and strikingly narrated by the Chroniclers of the Period. Embellished with highly-wrought Miniatures and Borderings, selected from various Illuminated MSS. referring to Events connected with English History. By HENRY NOEL HUMPHREYS. Post 8vo. in a richly carved and pierced binding, 21s.

HUNT.—RESEARCHES ON LIGHT:

An Examination of all the Phenomena connected with the Chemical and Molecular Changes produced by the Influence of the Solar Rays; embracing all the known Photographic Processes, and new Discoveries in the Art By Robert Hunt, Keeper of Mining Records, Museum of Economic Geology. 8vo. with Plate and Woodcuts, 10s. 6d. cloth.

JAMES.—A HISTORY OF THE LIFE OF EDWARD THE

BLACK PRINCE, and of various Events connected therewith, which occurred during the Reign of Edward III. King of England. By G. P. R. James, Esq. New Edition. 2 vols. fcp. 8vo. Map, 15s. cloth.

MRS. JAMESON.—LEGENDS OF THE MONASTIC ORDERS:

comprising the History of the Franciscans, as connected with the Revival of Art; Legends of those Royal Personages who died in the Religious Habit; and Notes on the Remains of English Legendary Art. By Mrs. Jameson, Author of "Sacred and Legendary Art," &c. Square crown 8vo. with numerous Illustrations. [*Nearly ready.*

⁂ To be followed by "Legends of the Madonna," by the same Author, similarly illustrated.

MRS. JAMESON.-SACRED AND LEGENDARY ART.

By Mrs. Jameson. With numerous Wood Engravings, and Sixteen Etchings by the Author. 2 vols. square crown 8vo. 42s. cloth.

JEBB.—A LITERAL TRANSLATION OF THE BOOK OF

PSALMS; intended to illustrate their Poetical and Moral Structure. To which are added. Dissertations on the word "Selah." and on the Authorship, Order, Titles, and Poetical Features, of the Psalms. By the Rev. John Jebb, A.M. 2 vols. 8vo. 21s. cloth.

JEFFREY.—CONTRIBUTIONS TO THE EDINBURGH

REVIEW. By Francis Jeffrey, now One of the Judges of the Court of Session in Scotland New Edition. 3 vols. 8vo. 42s. cloth.

BISHOP JEREMY TAYLOR'S ENTIRE WORKS:

With the Life by Bishop Heber Revised and corrected by the Rev. Charles Page Eden, Fellow of Oriel College, Oxford. Vols. II. III. IV.-V. and VI. 8vo. 10s. 6d. each.

⁂ In course of publication, in Ten Volumes, price Half-a-Guinea each.—Vol. I. (the *last* in order of *publication*) will contain Bishop Heber's Life of Jeremy Taylor, extended by the Editor.—Vol. VII. is *in the press.*

JOHNSON.—THE FARMER'S ENCYCLOPÆDIA,

And Dictionary of Rural Affairs: embracing all the recent Discoveries in Agricultural Chemistry; adapted to the comprehension of unscientific readers. By Cuthbert W. Johnson, Esq. F.R.S. Barrister-at-Law; Editor of the "Farmer's Almanack," &c. 8vo. with Wood Engravings, £2. 10s. cloth.

JOHNSON.—THE WISDOM OF THE RAMBLER, ADVENTURER, and IDLER:

comprising a Selection of 110 of the best Essays. By Samuel Johnson, LL.D. Fcp. 8vo. 7s. cloth.

SIR ROBERT KANE.—ELEMENTS OF CHEMISTRY,

Theoretical and Practical: including the most Recent Discoveries and Applications of the Science of Medicine and Pharmacy to Agriculture and to Manufactures. By Sir Robert Kane, M.D. M.R.I.A. 2d Edition, corrected and greatly enlarged; illustrated by 230 Wood Engravings. In One large Volume, 8vo. of about 1,100 pages, 28s. cloth.

KEMBLE.—THE SAXONS IN ENGLAND:

a History of the English Commonwealth till the period of the Norman Conquest. By John Mitchell Kemble, M.A. F.C.P.S., &c. 2 vols. 8vo. 28s. cloth.

KINDERSLEY.—THE VERY JOYOUS, PLEASANT, AND

REFRESHING HISTORY of the Feats, Exploits, Triumphs, and Achievements of the Good Knight, without Fear and without Reproach, the gentle LORD DE BAYARD. Set forth in English by Edward Cockburn Kindersley, Esq. With Ornamental Headings, and Frontispiece by E. H. Wehnert. Square post 8vo. 9s. 6d. cloth.

KIP.—THE CHRISTMAS HOLYDAYS IN ROME.

By the Rev. W. Ingraham Kip, M.A. Edited by the Rev. W. Sewell, B.D. Fellow and Tutor of Exeter College, Oxford. New Edition. Fcp. 8vo. 5s. cloth.

KIRBY & SPENCE.—AN INTRODUCTION TO ENTOMOLOGY;

Or, Elements of the Natural History of Insects: comprising an account of noxious and useful Insects, of their Metamorphoses, Food, Stratagems, Habitations, Societies, Motions, Noises, Hybernation, Instinct, &c. By W. Kirby, M.A. F.R.S. & L.S. Rector of Barham; and W. Spence, Esq. F.R.S. & L.S. New Edition. 2 vols. 8vo. with Plates, 31s. 6d. cloth.

LARDNER'S CABINET CYCLOPÆDIA;

Comprising a Series of Original Works on History, Biography, Natural Philosophy, Natural History, Literature, the Sciences, Arts, and Manufactures. By Bishop Thirlwall, Sir James Mackintosh, Sir John Herschel, Sir Walter Scott, Thomas Moore, Robert Southey, and other eminent Writers.

The Series, complete, in One Hundred and Thirty-three Volumes, £39. 18s. The works, separately, 6s. per volume.

THE SERIES COMPRISES:—

1.	Bell's History of Russia	3 vols.	18s.
2.	Bell's Lives of British Poets	2 vols.	12s.
3.	Brewster's Treatise on Optics	1 vol.	6s.
4.	Cooley's History of Maritime and Inland Discovery	3 vols.	18s.
5.	Crowe's History of France	3 vols.	18s.
*6.	De Morgan's Treatise on Probabilities	1 vol.	6s.
7.	De Sismondi's History of the Italian Republics	1 vol.	6s.
8.	De Sismondi's Fall of the Roman Empire	2 vols.	12s.
9.	Donovan's Treatise on Chemistry	1 vol.	6s.
10.	Donovan's Domestic Economy	2 vols.	12s.
11.	Dunham's History of Spain and Portugal	5 vols.	30s.
12.	Dunham's History of Denmark, Sweden, and Norway	3 vols.	18s.
13.	Dunham's History of Poland	1 vol.	6s.
14.	Dunham's History of the Germanic Empire	3 vols.	18s.
15.	Dunham's History of Europe during the Middle Ages	4 vols.	24s.
16.	Dunham's Lives of British Dramatists	2 vols.	12s.
17.	Dunham's Lives of Early Writers of Great Britain	1 vol.	6s.
18.	Fergus's History of the United States	2 vols.	12s.
19.	Fosbroke's Grecian and Roman Antiquities	2 vols.	12s.
20.	Forster's Lives of the Statesmen of the Commonwealth	5 vols.	30s.
21.	Forster, Mackintosh, and Courtenay's Lives of British Statesmen	7 vols.	42s.
22.	Gleig's Lives of Military Commanders	3 vols.	18s.
23.	Grattan's History of the Netherlands	1 vol.	6s.
24.	Henslow's Treatise on Botany	1 vol.	6s.
25.	Herschel's Treat. on Astronomy	1 vol.	6s.
26.	Herschel's Preliminary Discourse on the Study of Natural Philosophy	1 vol.	6s.
27.	History of Rome	2 vols.	12s.
28.	History of Switzerland	1 vol.	6s.
29.	Holland's Treatise on the Manufactures in Metal	3 vols.	18s.
30.	James's Lives of Foreign Statesmen	5 vols.	30s.
31.	Kater and Lardner's Treatise on Mechanics	1 vol.	6s.
32.	Keightley's Outlines of History	1 vol.	6s.
33.	Lardner's Treat. on Arithmetic	1 vol.	6s.
34.	Lardner's Treat. on Geometry	1 vol.	6s.
35.	Lardner's Treatise on Heat	1 vol.	6s.
36.	Lardner's Treatise on Hydrostatics and Pneumatics	1 vol.	6s.
37.	Lardner and Walker's Electricity and Magnetism	2 vols.	12s.
38.	Mackintosh, Wallace, and Bell's History of England	10 vols.	60s.
39.	Montgomery and Shelley's Lives of Italian, Spanish, and Portuguese Authors	3 vols.	18s.
40.	Moore's History of Ireland	4 vols.	24s.
41.	Nicolas's Chronol. of History	1 vol.	6s.
42.	Phillips's Treatise on Geology	2 vols.	12s.
43.	Powell's History of Natural Philosophy	1 vol.	6s.
44.	Porter's Treatise on the Manufacture of Silk	1 vol.	6s.
45.	Porter's Treatise on the Manufacture of Porcelain and Glass	1 vol.	6s.
46.	Roscoe's Lives of Brit. Lawyers	1 vol.	6s.
47.	Scott's History of Scotland	2 vols.	12s.
48.	Shelley's Lives of French Authors	2 vols.	12s.
49.	Shuckard and Swainson's Treatise on Insects	1 vol.	6s.
50.	Southey's Lives of British Admirals	5 vols.	30s.
51.	Stebbing's Hist. of the Church	2 vols.	12s.
52.	Stebbing's History of the Reformation	2 vols.	12s.
53.	Swainson's Preliminary Discourse on Natural History	1 vol.	6s.
54.	Swainson's Natural History and Classification of Animals	1 vol.	6s.
55.	Swainson's Habits and Instincts of Animals	1 vol.	6s.
56.	Swainson's Quadrupeds	1 vol.	6s.
57.	Swainson's Birds	2 vols.	12.
58.	Swainson's Fish, Reptiles, &c.	2 vols.	12s.
59.	Swainson's Shells and Shellfish	1 vol.	6s.
60.	Swainson's Animals in Menageries	1 vol.	6s.
61.	Swainson's Taxidermy and Bibliography	1 vol.	6s.
62.	Thirlwall's History of Greece	8 vols.	48s.

LAING.—THE CHRONICLE OF THE KINGS OF NORWAY,

From the Earliest Period of the History of the Northern Sea Kings to the Middle of the Twelfth Century, commonly called THE HEIMSKRINGLA. Translated from the Icelandic of Snorro Sturleson, with Notes, and a Preliminary Discourse, by Samuel Laing, Esq. 3 vols. 8vo. 36s. cloth.

LAING.—A TOUR IN SWEDEN,

In 1838; comprising observations on the Moral, Political, and Economical State of the Swedish Nation. By Samuel Laing, Esq. 8vo. 12s. cloth.

LANDOR.—THE FOUNTAIN OF ARETHUSA.

By Robert Eyres Landor, M.A. Author of "The Fawn of Sertorius," "The Impious Feast," Tragedies, &c. 2 vols. post 8vo. 18s. cloth.

LATHAM.—ON DISEASES OF THE HEART.

Lectures on Subjects connected with Clinical Medicine; comprising Diseases of the Heart. By P. M. Latham, M. D., Physician Extraordinary to the Queen; and late Physciian to St. Bartholomew's Hospital. New Edition. 2 vols. 12mo. 16s. cloth.

LEE.—ELEMENTS OF NATURAL HISTORY,

For the use of Schools and Young Persons: comprising the Principles of Classification interspersed with amusing and instructive original Accounts of the most remarkable Animals. By Mrs. R. Lee. 12mo. with Fifty-five Woodcuts, 7s. 6d. bound.

LEE.—TAXIDERMY;

Or, the Art of Collecting, Preparing, and Mounting Objects of Natural History. For the use of Museums and Travellers. By Mrs. R. Lee. New Edition, improved, with an account of a Visit to Walton Hall, and Mr. Waterton's Method of Preserving Animals. Fcp. 8vo. with Woodcuts, 7s. cloth.

L. E. L.—THE POETICAL WORKS OF LETITIA ELIZABETH

LANDON; comprising the IMPROVISATRICE, the VENETIAN BRACELET, the GOLDEN VIOLET, the TROUBADOUR, and other Poetical Remains. New Edition, uniform with the smaller Edition of Mr. Macaulay's "Lays of Ancient Rome," and Moore's "Songs, Ballads, and Sacred Songs." 2 vols. 16mo. with Vignette-titles. [*Nearly ready.*

⁂ Also, an Edition, in 4 vols. fcp. 8vo. with Illustrations by Howard, &c. 28s. cloth; or £2. 4s. bound in morocco.

LESLIE.—MEMOIRS OF THE LIFE OF JOHN CONSTABLE,

Esq. R.A. Composed chiefly of his Letters. By C. R. Leslie, Esq. R.A. New Edition, with further Extracts from his Correspondence. With two Portraits (one from a new Sketch by Mr. Leslie), and a Plate of "Spring," engraved by Lucas. Small 4to. 21s. cloth.

LETTERS TO MY UNKNOWN FRIENDS.

By A Lady, Author of "Twelve Years Ago." New Edition. Fcp. 8vo. 6s. 6d. cloth.

LINDLEY.—INTRODUCTION TO BOTANY.

By J. Lindley, Ph.D. F.R.S. L.S. &c. Professor of Botany in University College, London. New Edition, with Corrections and copious Additions. 2 vols. 8vo. with Six Plates and numerous Woodcuts, 24s. cloth.

LINDLEY.—A SYNOPSIS OF THE BRITISH FLORA,

Arranged according to the Natural Orders. By Professor John Lindley, Ph.D., F.R.S., &c. New Edition, with numerous additions and corrections. 12mo. 10s. 6d. cloth.

LINDLEY.—THE THEORY OF HORTICULTURE;

Or, an Attempt to explain the Principal Operations of Gardening upon Physiological Principles. By Professor John Lindley, Ph.D. F.R.S. 8vo. with Woodcuts, 12s. cloth.

LINDLEY.—GUIDE TO ORCHARD AND KITCHEN GARDEN;

Or, an Account of the most valuable Fruits and Vegetables cultivated in Great Britain: with Kalendars of the Work required in the Orchard and Kitchen Garden during every month in the year. By G. Lindley, C.M.H.S. Edited by Professor J. Lindley. 8vo. 16s. cloth.

LINWOOD.—ANTHOLOGIA OXONIENSIS,

Sive Florilegium e lusibus poeticis diversorum Oxoniensium Græcis et Latinis decerptum. Curante GULIELMO LINWOOD, M.A. Ædis Christi Alummo. 8vo. 14s. cloth.

LORIMER.—LETTERS TO A YOUNG MASTER MARINER

On some Subjects connected with his Calling. By the late CHARLES LORIMER. New Edit. Fcp. 8vo. 5s. 6d. cloth.

"This edition has been carefully revised, and some improvements and additions made to it. Nautical matters are not so much the subject of the book as the commercial duties and legal powers and responsibilities of the master mariner, under the critical circumstances in which he may continually find himself." SPECTATOR.

LOUDON.—THE AMATEUR GARDENER'S CALENDAR:

Being a Monthly Guide as to what should be avoided, as well as what should be done, in a Garden in each Month: with plain Rules *how to do* what is requisite; Directions for Laying Out and Planting Kitchen and Flower Gardens, Pleasure Grounds, and Shrubberies; and a short Account, in each Month, of the Quadrupeds, Birds, and Insects then most injurious to Gardens. By Mrs. LOUDON. 16mo. with Wood Engravings, 7s. 6d. cloth.

LOUDON.—THE LADY'S COUNTRY COMPANION;

Or, How to Enjoy a Country Life Rationally. By Mrs. LOUDON, Author of "Gardening for Ladies," &c. New Edition. Fcp. 8vo. with Plate and Wood Engravings, 7s. 6d. cloth.

LOUDON.—SELF-INSTRUCTION FOR YOUNG GARDENERS,

Foresters, Bailiffs, Land Stewards, and Farmers; in Arithmetic, Book-keeping, Geometry, Mensuration, Practical Trigonometry, Mechanics, Land-Surveying, Levelling, Planning and Mapping, Architectural Drawing, and Isometrical Projection and Perspective; with Examples shewing their applications to Horticulture and Agricultural Purposes. By the late J. C. LOUDON. With a Portrait of Mr. Loudon, and a Memoir by Mrs. Loudon. 8vo. with Woodcuts, 7s. 6d. cloth.

LOUDON.—AN ENCYCLOPÆDIA OF GARDENING:

Presenting, in one systematic view, the History and Present State of Gardening in all Countries, and its Theory and Practice in Great Britain: with the Management of the Kitchen Garden, the Flower Garden, Laying-out Grounds, &c. By J. C. LOUDON. New Edition, enlarged and improved. 8vo. with nearly 1,000 Engravings on Wood, 50s. cloth.

LOUDON.—AN ENCYCLOPÆDIA OF TREES AND SHRUBS:

being the "Arboretum et Fruticetum Britannicum" abridged: containing the Hardy Trees and Shrubs of Great Britain, Native and Foreign, Scientifically and Popularly Described; with their Propagation, Culture, and Uses in the Arts; and with Engravings of nearly all the Species. Adapted for the use of Nurserymen, Gardeners, and Foresters. By J. C. LOUDON. 8vo. with 2,000 Engravings on Wood, £2. 10s. cloth.

LOUDON.—AN ENCYCLOPÆDIA OF AGRICULTURE:

Comprising the Theory and Practice of the Valuation, Transfer, Laying-out, Improvement, and Management of Landed Property, and of the Cultivation and Economy of the Animal and Vegetable productions of Agriculture: including all the latest Improvements, a general History of Agriculture in all Countries, a Statistical View of its present State, with Suggestions for its future progress in the British Isles; and Supplement, bringing down the work to the year 1844. By J. C. LOUDON. New Edition. 8vo. with upwards of 1,100 Engravings on Wood, £2. 10s. cloth.

LOUDON.—AN ENCYCLOPÆDIA OF PLANTS:

Including all the Plants which are now found in, or have been introduced into, Great Britain; giving their Natural History, accompanied by such descriptions, engraved figures, and elementary details, as may enable a beginner, who is a mere English reader, to discover the name of every Plant which he may find in flower, and acquire all the information respecting it which is useful and interesting. By J. C. LOUDON. The Specific Characters by an Eminent Botanist; the Drawings by J. D. C. Sowerby. New Edition with Supplement, and new General Index. 8vo. with nearly 10,000 Wood Engravings, £3. 13s. 6d. cloth.

LOUDON.—AN ENCYCLOPÆDIA OF COTTAGE, FARM, AND

VILLA ARCHITECTURE and FURNITURE; containing numerous Designs, from the Villa to the Cottage and the Farm, including Farm Houses, Farmeries, and other Agricultural Buildings; Country Inns, Public Houses, and Parochial Schools; with the requisite Fittings-up, Fixtures, and Furniture, and appropriate Offices, Gardens, and Garden Scenery: each Design accompanied by Analytical and Critical Remarks. By J. C. LOUDON. New Edition, edited by Mrs. LOUDON. 8vo. with more than 2,000 Engravings on Wood, £3. 3s. cloth.

LOUDON.—HORTUS BRITANNICUS:

A Catalogue of all the Plants indigenous to or introduced into Britain. By J. C. Loudon. 3d Edition, with a New Supplement, prepared, under the direction of Mr. Loudon, by W. H. Baxter, and revised by George Don. 8vo. 31s. 6d. cloth.

LOUDON.—HORTUS LIGNOSIS LONDINENSIS;

Or, a Catalogue of all the Ligneous Plants cultivated in the neighbourhood of London. To which are added, their usual prices in Nurseries. By J. C. Loudon. 8vo. 7s. 6d. cloth.

LOW.—ON THE DOMESTICATED ANIMALS OF GREAT BRITAIN;

comprehending the Natural and Economical History of the Species and Breeds; Illustrations of the Properties of External Form; and Observations on the Principles and Practice of Breeding. By David Low, Esq. F.R.S.E. Professor of Agriculture in the University of Edinburgh. 8vo. with Engravings on Wood, 25s. cloth.

LOW.—THE BREEDS OF THE DOMESTICATED ANIMALS

Of Great Britain Described. By David Low, Esq. F.R.S.E. The Plates from Drawings by W. Nicholson, R.S.A. reduced from a Series of Oil Paintings, executed for the Agricultural Museum of the University of Edinburgh, by W. Shiels, R.S.A. 2 vols. atlas quarto, with 56 plates of animals, beautifully coloured after Nature, £16. 16s. half-bound in morocco.—Or in four separate portions, as follows:—

The OX. With 22 plates, £6. 16s. 6d.
The SHEEP. With 21 plates, £6. 16s. 6d.
The HORSE. With 8 plates, £3.
The HOG. With 5 plates, £2. 2s.

LOW.—ELEMENTS OF PRACTICAL AGRICULTURE;

Comprehending the Cultivation of Plants, the Husbandry of the Domestic Animals, and the Economy of the Farm. By D. Low, Esq. F.R.S.E. New Edition, with Alterations and Additions, and an entirely new set of above 200 Woodcuts. 8vo. 21s. cloth.

LOW.—ON LANDED PROPERTY,

And the ECONOMY of ESTATES; comprehending the Relation of Landlord and Tenant, and the Principles and Forms of Leases; Farm-Buildings, Enclosures, Drains, Embankments, and other Rural Works; Minerals; and Woods. By David Low, Esq. F.R.S.E. 8vo. with numerous Wood Engravings, 21s. cloth.

LOW.—AN INQUIRY INTO THE NATURE OF THE SIMPLE BODIES OF CHEMISTRY.

By D. Low, F.R.S.E. Author of "Elements of Practical Agriculture," "A Treatise on Landed Property and the Economy of Estates," "A Treatise on the Breeds of the British Domesticated Animals," "The Breeds of the Domesticated Animals of Great Britain Illustrated and Described." 2d Edition, enlarged and improved. 8vo. 9s. cloth.

MACAULAY.—THE HISTORY OF ENGLAND FROM THE ACCESSION OF JAMES II.

By Thomas Babbington Macaulay. 5th Edition. Vols. I. and II. 8vo. 32s. cloth.

MACAULAY.—CRITICAL AND HISTORICAL ESSAYS CONTRIBUTED to The EDINBURGH REVIEW.

By Thomas Babington Macaulay. 6th Edition. 3 vols. 8vo. 36s. cloth.

MACAULAY.—LAYS OF ANCIENT ROME.

With "Ivry" and "The Armada." By Thomas Babington Macaulay. New Edition. 16mo. 4s. 6d. cloth; or 10s. 6d. bound in morocco.

MR. MACAULAY'S LAYS OF ANCIENT ROME.

With numerous Illustrations, Original and from the Antique, drawn on Wood by George Scharf, Jun. and engraved by Samuel Williams. New Edition. Fcp. 4to. 21s. boards; morocco, 42s.

MACKAY.—THE SCENERY AND POETRY OF THE ENGLISH LAKES;

a Summer Ramble. By Charles Mackay, Esq. LL.D. Author of "The Thames and its Tributaries," &c. 8vo. with beautiful Wood Engravings from Original Sketches, 14s. cloth.

MACKINTOSH.—SIR JAMES MACKINTOSH'S MISCELLANEOUS WORKS;

including his Contributions to THE EDINBURGH REVIEW. Edited by Robert James Mackintosh, Esq. 3 vols. 8vo. 42s. cloth.

MACKINTOSH.—THE LIFE OF SIR THOMAS MORE.

By Sir James Mackintosh. Reprinted from the Cabinet Cyclopædia. Fcp. 8vo. with Portrait, 5s. cloth; or bound in vellum, 8s.

M'CULLOCH.—A DICTIONARY, PRACTICAL, THEORETICAL, AND HISTORICAL, OF COMMERCE AND COMMERCIAL NAVIGATION.

Illustrated with Maps and Plans. By J. R. M'Culloch, Esq. New Edition, (1849), corrected, enlarged, and improved; with a Supplement. 8vo. 50s. cloth; or 55s. half-bound in russia.

⁂ The Supplement to the last Edition, published in 1847, may be had separately, price 4s. 6d. sewed.

M'CULLOCH.—A DICTIONARY, GEOGRAPHICAL, STATISTICAL, AND HISTORICAL,

of the various Countries, Places, and Principal Natural Objects in the WORLD. By J. R. M'Culloch, Esq. New Edition (1849), revised and enlarged; including new articles on Australia, Austria, the British Empire, France, &c.: in 2 thick and closely-printed Volumes, illustrated with 6 large Maps 8vo. £4. cloth.

⁂ A Supplement to the Edition publishod in 1846 embodies the latest information with respect to the Australian Colonies, New Zealand, Natal, Labuan, &c. Price Half-a-Crown.

M'CULLOCH.—AN ACCOUNT, DESCRIPTIVE AND STATISTICAL,

of the BRITISH EMPIRE; exhibiting its Extent, Physical Capacities, Population, Industry, and Civil and Religious Institutions. By J. R. M'Culloch, Esq. New Edition corrected, enlarged, and greatly improved 2 thick vols. 8vo. 42s. cloth.

M'CULLOCH.—THE LITERATURE OF POLITICAL ECONOMY;

being a Classified Catalogue of the principal Works in the different departments of Political Economy, with Historical, Critical, and Biographical Notices By J. R. M'Culloch, Esq. 8vo. 14s. cloth.

M'CULLOCH.—A TREATISE ON THE SUCCESSION TO PROPERTY

Vacant by Death: including Inquiries into the Influence of Primogeniture, Entails, the Law of Compulsory Partition, Foundations, &c. over the Public Interests. By J. R. M'Culloch, Esq. 8vo. 6s. 6d. cloth.

M'CULLOCH.—A TREATISE ON THE PRINCIPLES AND PRACTICAL INFLUENCE of TAXATION and the FUNDING SYSTEM.

By J. R. M'Culloch, Esq. 8vo. 10s. cloth.

MADAME DE MALGUET:

A Tale of 1820. 3 vols. post 8vo. 31s. boards.

MAITLAND.—THE APOSTLES' SCHOOL OF PROPHETIC INTERPRETATION:

with its History to the Present Time. By Charles Maitland, Author of "The Church in the Catacombs." 8vo. 12s. cloth.

"We have no hesitation in recommending it to the consideration of all students of the prophetical writings, as one of the most valuable works that has ever appeared on the subject." British Magazine.

MAITLAND.—THE CHURCH IN THE CATACOMBS:

A Description of the Primitive Church of Rome. Illustrated by its Sepulchral Remains. By Charles Maitland. New Edition, corrected. 8vo. with numerous Wood Engravings, 14s. cloth.

MARCET.—CONVERSATIONS ON CHEMISTRY;

In which the Elements of that Science are familiarly Explained and Illustrated by Experiments. By Jane Marcet. New Edition, enlarged and improved. 2 vols. fcp. 8vo. 14s. cloth.

MARCET.—CONVERSATIONS ON NATURAL PHILOSOPHY;

In which the Elements of that Science are familiarly explained. By Jane Marcet. New Edition, enlarged and corrected. Fcp. 8vo. with 23 Plates, 10s. 6d. cloth.

MARCET.—CONVERSATIONS ON POLITICAL ECONOMY;

In which the Elements of that Science are familiarly explained. By Jane Marcet. New Edition revised and enlarged. Fcp. 8vo. 7s. 6d. cloth.

MARCET.—CONVERSATIONS ON VEGETABLE PHYSIOLOGY;
comprehending the Elements of Botany, with their application to Agriculture. By Jane Marcet. New Edition. Fcp. 8vo. with 4 Plates, 9s. cloth.

MARCET.—CONVERSATIONS ON LAND AND WATER.
By Jane Marcet. New Edition, revised and corrected. With a coloured Map, shewing the comparative altitude of Mountains. Fcp. 8vo. 5s. 6d. cloth.

THE MARRIAGE SERVICE (ILLUMINATED).
THE FORM of SOLEMNIZATION of MATRIMONY. From "The Book of Common Prayer." Illuminated, in the Missal Style, by Owen Jones. Sq. 18mo. 21s. [*Nearly ready.*

MARRYAT.—BORNEO AND THE EAST INDIAN ARCHIPELAGO.
By Francis S. Marryat, late Midshipman of H.M.S. Samarang Surveying Vessel. With many Drawings of Costume and Scenery, from Original Sketches made on the spot by Mr. Marryat. Imperial 8vo. with numerous Lithographic Plates and Wood Engravings, 31s. 6d. cloth.

MARRYAT.—MASTERMAN READY;
Or, the Wreck of the Pacific. Written for Young People. By Captain F. Marryat, C.B. Author of "Peter Simple," &c. 3 vols. fcp. 8vo. with Wood Engravings, 22s. 6d. cloth.

MARRYAT.—THE MISSION;
Or, Scenes in Africa. Written for Young People. By Captain F. Marryat, C.B. Author of "Masterman Ready," &c. 2 vols. fcp. 8vo. 12s. cloth.

MARRYAT.—THE PRIVATEER'S-MAN ONE HUNDRED YEARS AGO.
By Captain F. Marryat, C.B. Author of "Masterman Ready," &c. 2 vols. fcp. 8vo. 12s. cloth.

MARRYAT.—THE SETTLERS IN CANADA.
Written for Young People. By Captain F Marryat, C.B. Author of "Masterman Ready," &c. New Edition. Fcp. 8vo. with 2 Illustrations, 7s. 6d. cloth.

MATTEUCCI.—LECTURES ON THE PHYSICAL PHÆNOMENA OF LIVING BEINGS.
By Signor Carlo Matteucci, Professor in the University of Pisa. Translated under the superintendence of J. Pereira, M.D.F.R.S. Vice-President of the Royal Medical and Chirurgical Society. 12mo. 9s. cloth.

MAUNDER.—THE TREASURY OF KNOWLEDGE,
And LIBRARY of REFERENCE. Comprising an English Grammar; Tables of English Verbal Distinctions; Proverbs, Terms, and Phrases, in Latin, Spanish, French, and Italian, translated; New and Enlarged English Dictionary; Directions for Pronunciation; New Universal Gazetteer; Tables of Population and Statistics; List of Cities, Boroughs, and Market Towns in the United Kingdom; Regulations of the General Post Office; List of Foreign Animal, Vegetable, and Mineral Productions; Compendious Classical Dictionary; Scripture Proper Names accented, and Christian Names of Men and Women: with Latin Maxims translated; List of Abbreviations; Chronology and History; compendious Law Dictionary; Abstract of Tax Acts; Interest and other Tables; Forms of Epistolary Address; Tables of Precedency; Synopsis of the British Peerage; and Tables of Number, Money, Weights, and Measures By Samuel Maunder. 18th Edition, revised throughout, and greatly enlarged. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

MAUNDER.—THE SCIENTIFIC & LITERARY TREASURY;
A new and popular Encyclopædia of Science and the Belles-Lettres; including all Branches of Science, and every Subject connected with Literature and Art. The whole written in a familiar style, adapted to the comprehension of all persons desirous of acquiring information on the subjects comprised in the work, and also adapted for a Manual of convenient Reference to the more instructed. By S. Maunder. New Edition. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

MAUNDER.—THE TREASURY OF NATURAL HISTORY;
Or, a Popular Dictionary of Animated Nature: in which the Zoological Characteristics that distinguish the different Classes, Genera, and Species are combined with a variety of interesting Information illustrative of the Habits, Instincts and General Economy of the Animal Kingdom. To which are added, a Syllabus of Practical Taxidermy, and a Glossarial Appendix. Embellished with 900 accurate Engravings on Wood, from Drawings made expressly for this work. By Samuel Maunder. New Edition. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

MAUNDER.—THE BIOGRAPHICAL TREASURY;

Consisting of Memoirs, Sketches, and brief Notices of above 12,000 Eminent Persons of all Age. and Nations, from the Earliest Period of History; forming a new and complete Dictionary of Universal Biography. By Samuel Maunder. New Edition, revised throughout, and containing a copious Supplement. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

MAUNDER.—THE TREASURY OF HISTORY;

Comprising a General Introductory Outline of Universal History, Ancient and Modern, and a Series of separate Histories of every principal Nation that exists; their Rise, Progress, and Present Condition, the Moral and Social Character of their respective inhabitants, their Religion, Manners, and Customs, &c. By Samuel Maunder. New Edition. Fcp. 8vo. 10s. cloth; bound in roan, 12s.

MAXIMS AND PRECEPTS OF THE SAVIOUR:

Being a Selection of the most beautiful Christian Precepts contained in the Four Gospels; illustrated by a series of Illuminations of original character, founded on the Passages—"Behold the Fowls of the Air," &c., "Consider the Lilies of the Field," &c. In a rich binding, in the style of the celebrated opus Anglicum. Square fcp. 8vo. 21s.; or 30s. bound in morocco.

MEMOIRS OF THE GEOLOGICAL SURVEY OF GREAT

BRITAIN, and of the Museum of Economic Geology in London. Published by order of the Lords Commissioners of Her Majesty's Treasury. Royal 8vo. with Woodcuts and 9 large Plates (seven coloured), 21s. cloth; and Vol. II. in Two thick Parts, with 63 Plates (three coloured), and numerous Woodcuts, 42s. cloth, or, separately, 21s. each Part.——Also, BRITISH ORGANIC REMAINS; consisting of Plates of Figures engraved on Steel, with descriptive Letterpress, and forming a portion of the Memoirs of the Geological Survey. Decades I. and II. royal 8vo. 2s. 6d. each; or, royal 4to. 4s. 6d. each, sewed.

MERIVALE.—A HISTORY OF ROME UNDER THE

EMPERORS. Book the First, "Julius Cæsar." By the Rev. Charles Merivale. 2 vols. 8vo. *Nearly ready.*

MILNER.—THE HISTORY OF THE CHURCH OF CHRIST.

By the Rev. Joseph Milner, A.M. With Additions and Corrections by the Late Rev. Isaac Milner, D.D. F.R.S. A New Edition, revised and corrected throughout, by the Rev. T. Grantham, B.D. Rector of Bramber, and Chaplain to the Lord Bishop of Kildare. 4 vols. 8vo. £2. 12s. cloth.

THE MIRACLES OF OUR SAVIOUR (ILLUMINATED).

With rich and appropriate Borders of original Design, a series of Illuminated Figures of the Apostles, from the Old Masters, six Illuminated Miniatures, and other embellishments. By the Illuminator of the "Parables." Square fcp. 8vo. in massive carved covers, 21s.; or bound in morocco, 30s.

MITCHELL.—JOURNAL OF AN EXPEDITION INTO THE

Interior of Tropical Australia, in Search of a Route from Sydney to the Gulf of Carpentaria. By Lieut.-Colonel Sir T. L. Mitchell, Knt. D.C.L. Surveyor-General of New South Wales, and late elective Member of the Legislative Council of that Colony. 8vo. with Maps, Views, and Engravings of Objects of Natural History, 21s. cloth.

JAMES MONTGOMERY'S POETICAL WORKS.

New and only Complete Edition. With some additional Poems, and Autobiographical Prefaces. Collected and Edited by Mr. Montgomery. 4 vols. fcp. 8vo. with Portrait, and Seven other Plates, 20s. cloth; or bound in morocco, 36s.

MOORE.—MAN AND HIS MOTIVES.

By George Moore, M.D. Member of the Royal College of Physicians, London, &c.; Author of "The Power of the Soul over the Body," and "The Use of the Body in relation to the Mind." New Edition. Post 8vo. 8s. cloth.

MOORE.—THE POWER OF THE SOUL OVER THE BODY,

Considered in relation to Health and Morals. By George Moore, M.D. Member of the Royal College of Physicians, London. &c. New Edition. Post 8vo. 7s. 6d. cloth.

MOORE.—THE USE OF THE BODY IN RELATION TO THE

MIND. By George Moore, M.D. Member of the Royal College of Physicians, London, &c. New Edition. Post 8vo. 9s. cloth.

THOMAS MOORE'S POETICAL WORKS;

Containing the Author's recent Introduction and Notes. Complete in one volume, uniform with Lord Byron's and Southey's Poems. With a New Portrait, by George Richmond, and a View of the Residence of the Poet. 8vo. 21s. cloth; or 42s. bound in morocco.

*** Also, an Edition in 10 vols. fcp. 8vo. with Portrait, and 19 Plates, £2. 10s. cloth; bound in morocco, £4. 10s.

MOORE.—SONGS, BALLADS, AND SACRED SONGS.

By Thomas Moore, Author of "Lalla Rookh," "Irish Melodies," &c. First collected Edition, uniform with the New Edition of Moore's "Irish Melodies," and "Lalla Rookh." 16mo. with Vignette Title. [*In October.*

MOORE'S IRISH MELODIES.

New and Cheaper Edition, uniform with the smaller Edition of Mr. Macaulay's "Lays of Ancient Rome." With the Autobiographical Preface from the Collective Edition of Mr. Moore's Poetcal Works, and a Vignette by D. Maclise, R.A., Engraved on Wood by J. Thompson. 16mo. 5s. cloth; or 12s. 6d. bound in morocco, by Hayday.

MOORE'S IRISH MELODIES.

With Vignette Title, from a design by Corbould. New Edition. Fcp. 8vo. 10s. cloth; or, bound in morocco, 13s. 6d.

MOORE'S IRISH MELODIES.

Illustrated by D. Maclise, R.A. Imperial 8vo. with 161 Steel Plates, £3. 3s. boards; or £4. 14s. 6d. bound in morocco, by Hayday. Proof Impressions (only 200 copies printed, of which a few remain), £6. 6s boards.

MOORE'S LALLA ROOKH: AN ORIENTAL ROMANCE.

New and Cheaper Edition, uniform with the smaller Edition of Mr. Macaulay's "Lays of Ancient Rome." With the Autobiographical Preface from the Collective Edition of Mr. Moore's Poetical Works, and a Vignette by D. Maclise, R.A., Engraved on Wood by J. Thompson. 16mo. 5s. cloth; or 12s. 6d. bound in morocco, by Hayday.

MOORE'S LALLA ROOKH: AN ORIENTAL ROMANCE.

With Four Engravings, from Paintings by Westall. New Edition. Fcp. 8vo. 10s. 6d. cloth; or, bound in morocco, 14s.

MOORE'S LALLA ROOKH: AN ORIENTAL ROMANCE.

With 13 Plates from Designs by Corbould, Meadows, and Stephanoff, engraved under the superintendence of Mr. Charles Heath. 8vo. 21s. cloth; morocco, 35s; or, with India Proof Plates, 42s. cloth.

MORELL.—THE PHILOSOPHY OF RELIGION.

By J. D. Morell, M.A. Author of an Historical and Critical "View of the Speculative Philosophy of Europe in the Nineteenth Century." 8vo. 12s. cloth.

MOSELEY. THE MECHANICAL PRINCIPLES OF ENGINEERING AND ARCHITECTURE.

By the Rev. H. Moseley, M.A. F.R.S., Professor of Natural Philosophy and Astronomy in King's College, London; and Author of "Illustrations of Practical Mechanics," &c. 8vo. with Woodcuts and Diagrams, 24s. cloth.

MOSELEY.—ILLUSTRATIONS OF PRACTICAL MECHANICS.

By the Rev. H. Moseley, M.A., Professor of Natural Philosophy and Astronomy in King's College, London; being the First Volume of the Illustrations of Science by the Professors of King's College. New Edition. Fcp. 8vo. with numerous Woodcuts, 8s. cloth.

MOSHEIM'S ECCLESIASTICAL HISTORY,

Ancient and Modern. Translated, with copious Notes, by James Murdock, D.D. New Edition, revised, and continued to the present time, by the Rev. Henry Soames, M.A. 4 vols. 8vo. 48s. cloth.

MURE.—A CRITICAL HISTORY OF THE LANGUAGE AND LITERATURE OF ANCIENT GREECE,

from the Earliest Period to the Death of Solon. By William Mure, M.P., of Caldwell. 3 vols. 8vo. [*In the press.*

MURRAY.—ENCYCLOPÆDIA OF GEOGRAPHY;

Comprising a complete Description of the Earth: exhibiting its Relation to the Heavenly Bodies, its Physical Structure, the Natural History of each Country, and the Industry, Commerce, Political Institutions, and Civil and Social State of all Nations. By Hugh Murray, F.R.S.E.: assisted by other Writers of eminence. New Edition. 8vo. with 82 Maps, and upwards of 1,000 other Woodcuts, £3, cloth.

NEALE.—THE CLOSING SCENE;

Or, Christianity and Infidelity contrasted in the Last Hours of Remarkable Persons. By the Rev. ERSKINE NEALE, M.A., Rector of Kirton, Suffolk; Author of "The Bishop's Daughter," "Self-Sacrifice," "The Life-Book of a Labourer," &c. New Edition. 2 vols. fcp. 8vo. 13s. cloth.

*** Separately—Vol. I. (First Series), 6s.; Vol. II. (Second Series), 7s.

NECKER DE SAUSSURE.—PROGRESSIVE EDUCATION;

Or, Considerations on the Course of Life. Translated and abridged from the French of Madame NECKER DE SAUSSURE, by Miss HOLLAND. 3 vols. fcp. 8vo. 19s. 6d. cloth.

*** Separately—Vols. I. and II. 12s.; Vol. III. 7s. 6d.

OWEN.—LECTURES ON THE COMPARATIVE ANATOMY

and PHYSIOLOGY of the INVERTEBRATE ANIMALS, delivered at the Royal College of Surgeons in 1843. By RICHARD OWEN, F.R.S. Hunterian Professor to the College. 8vo. with nearly 140 Wood Engravings, 14s. cloth.

OWEN.—LECTURES ON THE COMPARATIVE ANATOMY

and PHYSIOLOGY of the VERTEBRATE ANIMALS, delivered at the Royal College of Surgeons in 1844 and 1846. By RICHARD OWEN, F.R.S. Hunterian Professor to the College. In 2 vols. Vol. I. 8vo. with numerous Woodcuts, 14s. cloth.

PARABLES OF OUR LORD (ILLUMINATED).

PARABLES of OUR LORD, richly illuminated, with appropriate Borders, printed in Colours and in Black and Gold; with a Design from one of the early German Engravers. Square fcp. 8vo. 21s. in a massive carved binding; or 30s. bound in morocco.

PARKES.—DOMESTIC DUTIES;

Or, Instructions to Young Married Ladies on the Management of their Households, and the Regulation of their Conduct in the various Relations and Duties of Married Life. By Mrs. W. PARKES. New Edition. Fcp. 8vo. 9s. cloth.

PARNELL.—A TREATISE ON ROADS,

Wherein the Principles on which Roads should be made are explained and illustrated by the Plans, Specifications, and Contracts, made use of by Thomas Telford, Esq. on the Holyhead Road. By SIR HENRY PARNELL, Bart. New Edition, 8vo. with 9 Plates, 21s. cloth.

PARROT.—THE ASCENT OF MOUNT ARARAT.

By Dr. FRIEDRICH PARROT, Professor of Natural Philosophy in the University of Dorpat, Russian Imperial Councillor of State, &c. Translated and Edited by W. D. COOLEY, Esq. Author of the "History of Maritime and Inland Discovery," &c. 8vo. with a Map by Arrowsmith, and Woodcuts, 14s. cloth.

PASCAL'S MISCELLANEOUS WRITINGS:

Consisting of Correspondence with Relatives and Friends; Letter on the Death of his Father, in a complete state, from original sources; Philosophical Treatises; Discourse on the "Passion of Love" (lately discovered); Essay on the Art of Persuasion, and Notes on Eloquence and Style; Conversations—On the Condition of the Great, &c.; detached Thoughts and Notes, &c.: the greater part never before published in this Country, and large portions from Original MSS. Arranged and translated from the French Edition of M. P. Faugère, with Introduction, Editorial Notices, Notes, &c. By G. PEARCE, Esq. Post 8vo. 8s. 6d. cloth.

PASCAL'S PROVINCIAL LETTERS:

With an "Essay on Pascal, considered as a Writer and Moralist," by M. VILLEMAIN, Peer of France, late Minister of Public Instruction, &c. Newly translated from the French, with Memoir, Notes, and Appendix, by G. PEARCE, Esq. Post 8vo. with Portrait, 8s. 6d. cloth.

PEREIRA.—A TREATISE ON FOOD AND DIET:

With Observations on the Dietetical Regimen suited for Disordered States of the Digestive Organs; and an Account of the Dietaries of some of the principal Metropolitan and other Establishments for Paupers, Lunatics, Criminals, Children, the Sick, &c. By JON. PEREIRA, M.D. F.R.S. & L.S. Author of "Elements of Materia Medica." 8vo. 16s. cloth.

PESCHEL.—ELEMENTS OF PHYSICS.

By C. F. PESCHEL, Principal of the Royal Military College, Dresden. Translated from the German, with Notes, by E. WEST. 3 vols. fcp. 8vo. with Diagrams and Woodcuts, 21s. cloth.

Separately { Part 1. The Physics of Ponderable Bodies. Fcp. 8vo. 7s. 6d. cloth.
Part 2. Imponderable Bodies (Light, Heat, Magnetism, Electricity, and Electro-Dynamics). 2 vols. fcp. 8vo. 13s. 6d. cloth.

PHILLIPS.—AN ELEMENTARY INTRODUCTION TO MINERALOGY;

comprising a Notice of the Characters, Properties, and Chemical Constitution of Minerals: with Accounts of the Places and Circumstances in which they are found. By William Phillips, F.L.S.M.G.S. &c. A New Edition, corrected, enlarged, and improved, by H. G. Brooke, F.R.S.; and W. H. Miller, M.A., F.R.S., Professor of Mineralogy in the University of Cambridge. 8vo. with numerous Wood Engravings. [*In the press.*

PHILLIPS.—FIGURES AND DESCRIPTIONS OF THE

PALÆOZOIC FOSSILS of CORNWALL, DEVON, and WEST SOMERSET; observed in the course of the Ordnance Geological Survey of that District. By John Phillips, F.R.S. F.G.S. &c. Published by Order of the Lords Commissioners of H.M. Treasury. 8vo. with 60 Plates, comprising very numerous figures, 9s. cloth.

PLUNKETT.—THE PAST AND FUTURE OF THE BRITISH

NAVY. By Captain the Hon. E. Plunkett, R.N. Second Edition, corrected and enlarged; with Notes, and new Information communicated by several Officers of Distinction. Post 8vo. 8s. 6d. cloth.

THE POCKET AND THE STUD;

Or, Practical Hints on the Management of the Stable. By Harry Hieover. Author of "Stable-Talk and Table-Talk; or, Spectacles for Young Sportsmen." Fcp. 8vo. with Portrait of the Author on his favourite Horse "Harlequin," 5s. half-bound.

PORTLOCK.—REPORT ON THE GEOLOGY OF THE COUNTY

of LONDONDERRY, and of Parts of Tyrone and Fermanagh, examined and described under the Authority of the Master-General and Board of Ordnance. By J. E. Portlock, F.R.S. &c. 8vo. with 48 Plates, 24s. cloth.

POWER.—SKETCHES IN NEW ZEALAND,

with Pen and Pencil. By W. Tyrone Power, D.A.C.G. From a Journal kept in that Country, from July 1846 to June 1848. With 8 Plates and 2 Woodcuts, from Drawings made on the spot. Post 8vo. 12s. cloth.

"The book is very pleasantly written, crowded with picturesque sketches by both pen and pencil, and exhibits, with brevity and clearness, a complete review of the past and present relations, complicated enough in their origin and progress, between the native tribes, the New Zealand Company, the British Government, and the settlers. We have not seen the case of New Zealand stated so fairly or so intelligibly elsewhere. Mr. Power's personal narrative considerably enhances the interest and value of his statements. His journeys up rivers and mountains, and in various directions across a trackless country, his intercourse with the natives, and the incidents of savage life which every now and then rose upon his course, are full of excitement, and bring out in their details an effective picture of the colony."

Bentley's Miscellany.

PYCROFT.—THE COLLEGIAN'S GUIDE;

Or, Recollections of College Days: setting forth the Advantages and Temptations of an University Education. By the Rev. James Pycroft, B.A., Author of "A Course of English Reading," &c. Post 8vo. 10s. 6d. cloth.

PYCROFT.—A COURSE OF ENGLISH READING,

Adapted to every Taste and Capacity: with Anecdotes of Men of Letters. By the Rev. James Pycroft, B.A. Author of "The Collegian's Guide, &c." Fcp. 8vo. 6s. 6d. cloth.

RANKE'S HISTORY OF THE REFORMATION.

Translated by Sarah Austin, Translator of Ranke's "History of the Popes." Vols. I. and II. 8vo. 30s., Vol. III. 18s., cloth.

READER.—TIME TABLES

On a New and Simplified Plan; to facilitate the Operation of Discounting Bills, and the Calculation of Interest on Banking and Current Accounts, &c.: shewing, without calculation, the Number of Days from every Day in the Year to any other Day, for any period not exceeding 365 Days. By Thomas Reader. Post 8vo. 14s. cloth; or 17s. calf lettered.

REID.—ILLUSTRATIONS OF THE PRINCIPLES AND

PRACTICE of WARMING and VENTILATING, with Preliminary Remarks on Health and Length of Life. By D. B. Reid, M.D. F.R.S.E. 8vo. with Diagrams and Woodcuts, 16s. cloth.

REST IN THE CHURCH.

By the Author of "From Oxford to Rome; and, How it Fared with some who lately made the Journey." New Edition. Fcp. 8vo. 6s. 6d. cloth.

RICH.—THE ILLUSTRATED COMPANION TO THE LATIN

DICTIONARY AND GREEK LEXICON: forming a Glossary of all the Words representing Visible Objects connected with the Arts, Manufactures, and Every-day Life of the Ancients. With Representations of nearly Two Thousand Objects from the Antique. By Anthony Rich, Jun. B.A. late of Caius College, Cambridge Post 8vo. with about 2,000 Woodcuts, 21s. cloth.

RICHTER.—LEVANA; OR, THE DOCTRINE OF EDUCATION.

Translated from the German of Jean Paul Fr. Richter. Post 8vo. 10s. 6d. cloth.

RIDDLE.—A COPIOUS AND CRITICAL LATIN-ENGLISH LEXICON,

founded on the German-Latin Dictionaries of Dr. William Freund. By the Rev. J. E. Riddle, M.A. Author of "A Complete Latin-English and English-Latin Dictionary," "Ecclesiastical Chronology," &c. Post 4to. uniform with "Liddell and Scott's Greek Lexicon," £2. 10s. cloth.

RIDDLE.—A COMPLETE LATIN-ENGLISH AND ENGLISH-LATIN DICTIONARY,

for the use of Colleges and Schools. By the Rev. J. E. Riddle, M.A. New Edition. 8vo. 31s. 6d. cloth.

Separately { The English-Latin Dictionary, 10s. 6d. cloth.
The Latin-English Dictionary, 21s. cloth.

RIDDLE.—A DIAMOND LATIN-ENGLISH DICTIONARY.

For the Waistcoat-pocket. A Guide to the Meaning, Quality, and right Accentuation of Latin Classical Words. By the Rev. J. E. Riddle, M.A. New Edition. Royal 32mo. 4s. bound.

RIDDLE.-ECCLESIASTICAL CHRONOLOGY;

Or, Annals of the Christian Church, from its Foundation to the present Time. Containing a View of General Church History, and the Course of Secular Events; the Limits of the Church and its Relations to the State; Controversies; Sects and Parties; Rites, Institutions, and Discipline, &c. By the Rev. J. E. Riddle, M.A. 8vo. 15s. cloth.

RIDDLE.—LETTERS FROM AN ABSENT GODFATHER;

Or, a Compendium of Religious Instruction for Young Persons. By the Rev. J. E. Riddle, M.A. Fcp. 8vo. 6s. cloth.

RITCHIE.—RAILWAYS: THEIR RISE AND PROGRESS, and CONSTRUCTION.

With Remarks on Railway Accidents, and Proposals for their Prevention. By Robert Ritchie, Esq. F.R.S. S.A. Associate of the Institute of Civil Engineers. Fcp. 8vo. with Woodcut and Diagrams, 9s. cloth.

RIVERS.—THE ROSE AMATEUR'S GUIDE;

Containing ample Descriptions of all the fine leading varieties of Roses, regularly classed in their respective Families; their History and mode of Culture. By T. Rivers, Jun. New Edition, corrected and improved. Fcp. 8vo. 6s. cloth.

ROBINSON.—THE WHOLE ART OF CURING, PICKLING, AND SMOKING MEAT AND FISH,

both in the British and Foreign Modes. With many useful Miscellaneous Receipts, and full Directions for the Construction of an economical Drying Chimney and Apparatus, on an entirely New Plan. By James Robinson, Eighteen Years a Practical Curer. Fcp. 8vo. 4s. 6d. cloth.

ROBINSON.—THE WHOLE ART OF MAKING BRITISH WINES, CORDIALS, and LIQUEURS,

in the greatest Perfection; as also Strong and Cordial Waters. To which is added, a Collection of Valuable Recipes for Brewing Fine and Strong Ales, and Miscellaneous Articles connected with the Practice. By James Robinson. Fcp, 8vo. 6s. cloth.

ROGERS.—THE VEGETABLE CULTIVATOR;

Containing a plain and accurate Description of all the different Species of Culinary Vegetables, with the most approved Method of Cultivating them by Natural and Artificial Means, and the best Modes of Cooking them. Together with a Description of the Physical Herbs in general Use. By J. Rogers, Author of "The Fruit Cultivator." New Edition. Fcp. 8vo. 7s. cloth.

ROWTON.—THE FEMALE POETS OF GREAT BRITAIN,

Chronologically arranged: with copious Selections, and Critical Remarks. By Frederic Rowton, Author of "The Debater." Square crown 8vo. 14s. cloth.

ROWTON.—THE DEBATER;

Being a Series of complete Debates, Outlines of Debates, and Questions for Discussion; with ample References to the best Sources of Information on each particular Topic. By Frederic Rowton, Author of "The Female Poets of Great Britain." Fcp. 8vo. 6s. cloth.

SANDBY.—MESMERISM AND ITS OPPONENTS.

By GEORGE SANDBY, M.A. Vicar of Flixton, Suffolk. New Edition, considerably enlarged; with an Introductory Chapter on the Hostility of Scientific and Medical Men to Mesmerism. 16mo. 5s. cloth; or in 2 Parts, 2s. each.

SANDFORD—PAROCHIALIA,

Or, Church, School, and Parish. By JOHN SANDFORD, B.D. Vicar of Dunchurch, Chaplain to the Lord Bishop of Worcester, and Rural Dean. 8vo. with Woodcuts, 16s. cloth.

SANDFORD.—WOMAN IN HER SOCIAL AND DOMESTIC CHARACTER.

By Mrs. JOHN SANDFORD. New Edition. Fcp. 8vo. 6s. cloth.

SANDFORD.—FEMALE IMPROVEMENT.

By Mrs. JOHN SANDFORD. New Edition. Fcp. 8vo. 7s. cloth.

SCHLEIDEN.—PRINCIPLES OF SCIENTIFIC BOTANY;

Or, Botany as an Inductive Science. By Dr. M. J. SCHLEIDEN, Extraordinary Professor of Botany in the University of Jena. Translated by EDWIN LANKESTER, M.D. F.R.S. F.L.S. Lecturer on Botany at the St. George's School of Medicine, London. 8vo. with Plates and Woodcuts, 21s. cloth.

"We congratulate our readers on the appearance of an English edition of this remarkable work, by a gentleman so capable to do full justice to it as Dr. Lankester. It cannot fail to interest deeply all true lovers of Botanical Science, and we believe it will be considered a valuable addition to our botanical literature."

JAMESON'S PHILOSOPHICAL JOURNAL.

SCOFFERN.—THE MANUFACTURE OF SUGAR,

In the Colonies and at Home, chemically considered. By JOHN SCOFFERN, M.B. Lond. late Professor of Chemistry at the Aldersgate College of Medicine. 8vo. with Illustrations (one coloured) 10s. 6d. cloth.

SEAWARD.—SIR EDWARD SEAWARD'S NARRATIVE OF HIS SHIPWRECK,

and consequent Discovery of certain Islands in the Caribbean Sea: with a detail of many extraordinary and highly interesting Events in his Life, from 1733 to 1749, as written in his own Diary. Edited by Miss JANE PORTER. 3d Edition, with a New Nautical and Geographical Introduction. 2 vols. post 8vo. 21s. cloth.

SENIOR.—CHARLES VERNON:

A Transatlantic Tale. By Lieut.-Colonel HENRY SENIOR. 2 vols. post 8vo. 21s. boards.

THE SERMON ON THE MOUNT.

Printed in Gold and Colours, in the Missal style; with Ornamental Borders by OWEN JONES, Architect, and an illuminated Frontispiece by W. BOXALL, Esq. New Edition. Fcp. 4to. in a rich brocaded silk cover, 21s.; or bound in morocco, by Hayday, 25s.

SEWELL.—AMY HERBERT.

By a LADY. Edited by the Rev. WILLIAM SEWELL, B.D. Fellow and Tutor of Exeter College, Oxford. New Edition. 2 vols. fcp. 8vo. 9s. cloth.

SEWELL.—GERTRUDE.

A Tale. By the Author of "Amy Herbert." Edited by the Rev. WILLIAM SEWELL, B.D. Fellow and Tutor of Exeter College, Oxford. New Edition. 2 vols. fcp. 8vo. 9s. cloth.

SEWELL.—LANETON PARSONAGE:

A Tale for Children, on the Practical Use of a portion of the Church Catechism. By the Author of "Amy Herbert." Edited by the Rev. W. SEWELL, B.D. Fellow and Tutor of Exeter College, Oxford. New Edition. 3 vols. fcp. 8vo. 16s. cloth.

SEWELL.—MARGARET PERCIVAL.

By the Author of "Amy Herbert." Edited by the Rev. W. SEWELL, B.D. Fellow and Tutor of Exeter College, Oxford. New Edition. 2 vols. fcp. 8vo. 12s. cloth.

SHAKSPEARE, BY BOWDLER.

THE FAMILY SHAKSPEARE; in which nothing is *added* to the Original Text; but those words and expressions are *omitted* which cannot with propriety be read aloud. By T. BOWDLER, Esq. F.R.S. New Edition. 8vo. with 36 Engravings on Wood, from designs by Smirke, Howard, and other Artists, 21s. cloth; or, in 8 vols. 8vo. without Illustrations, £4. 14s. 6d. boards.

SHORT WHIST:

Its Rise, Progress, and Laws; with Observations to make any one a Whist Player; containing also the Laws of Piquet, Cassino, Ecarté, Cribbage, Backgammon. By Major A * * * * *. New Edition. To which are added, Precepts for Tyros. By Mrs. B * * * *. Fcp. 8vo. 3s cloth.

THE GOOD SHUNAMMITE.

From the Holy Scriptures. With Six Original Designs by A. KLEIN, and an Ornamental Border to each page, in the Missal style, by L. GRUNER, printed in Colours and Gold. Square fcp. 8vo. 21s. in massive carved covers; or 30s. bound in morocco.

SINCLAIR.—SIR EDWARD GRAHAM;

Or, Railway Speculators. By CATHERINE SINCLAIR, Author of "Modern Accomplishments," &c. 3 vols. post 8vo. [*Nearly ready.*

SINCLAIR.—THE BUSINESS OF LIFE.

By CATHERINE SINCLAIR, Author of "The Journey of Life," "Modern Society," "Jane Bouverie," &c 2 vols. fcap 8vo. 10s. cloth.

"The authoress has succeeded in imparting to reflections of a strongly religious nature the charms of literary embellishment. These essays or reflections will be found full of interest, as well as of instructive matter. Miss Sinclair has brought all the resources of a richly stored and highly cultivated mind to bear upon the subject of religion; and has executed her task with so much good taste, feeling, and judgment, that no one can read the work without deriving pleasure as well as instruction from the perusal"—SUNDAY TIMES.

SINCLAIR.—THE JOURNEY OF LIFE.

By CATHERINE SINCLAIR, Author of "The Business of Life," "Modern Society," "Jane Bouverie," &c. New Edition, corrected and enlarged. Fcp. 8vo. 5s. cloth.

SINNETT.—BYWAYS OF HISTORY,

From the Twelfth to the Sixteenth Century. By Mrs. PERCY SINNETT. 2 vols. post 8vo. 18s. cloth.

SIR ROGER DE COVERLEY.

From the Spectator. With Notes and Illustrations, and Engravings on Wood from Designs by FREDERICK TAYLER, Member of the Society of Painters in Water Colours. [*Nearly ready.*

THE SKETCHES:

Three Tales. By the Authors of "Amy Herbert," "The Old Man's Home," and "Hawkstone." New Edition. Fcp. 8vo. with 6 Plates, 8s. cloth.

SMITH.—THE WORKS OF THE REV. SYDNEY SMITH:

Including his Contributions to THE EDINBURGH REVIEW, PETER PLYMLEY'S LETTERS, and other Miscellaneous Writings. New Edition, with Additions. 3 vols. 8vo. with Portrait, 36s. cloth.

SMITH.—SERMONS PREACHED AT ST. PAUL'S CATHEDRAL,

the Foundling Hospital, and several Churches in London; together with others addressed to a Country Congregation. By the late Rev. SYDNEY SMITH, Canon Residentiary of St. Paul's Cathedral. 8vo. 12s. cloth.

SMITH.—SACRED ANNALS;

Or, Researches into the History and Religion of Mankind, from the Creation of the World to the Death of Isaac: deduced from the Writings of Moses and other Inspired Authors, copiously illustrated and confirmed by the Ancient Records, Traditions, and Mythology of the Heathen World. By GEORGE SMITH, F.A.S. Crown 8vo. 10s. cloth.

⁂ Vol. II. comprising the History and Religion of the Hebrew People, from the Origin of the Nation to the time of Christ, is *nearly ready.*

SMITH.—THE RELIGION OF ANCIENT BRITAIN HISTORICALLY CONSIDERED:

or, a Succinct Account of the several Religious Systems which have obtained in this Island from the Earliest Times to the Norman Conquest: including an Investigation into the Early Progress of Error in the Christian Church, the Introduction of the Gospel into Britain, and the State of Religion in England till Popery had gained the ascendancy. By GEORGE SMITH, F.A.S. New Edition. 8vo. 7s. 6d. cloth.

SMITH.—PERILOUS TIMES;

Or, the Aggressions of Antichristian Error on Scriptural Christianity, considered in reference to the Dangers and Duties of Protestants. By GEO. SMITH, F.A.S. Fcp. 8vo. 6s. cloth.

SMITH.—THE VOYAGE AND SHIPWRECK OF ST. PAUL:

with Dessertations on the Sources of the Writings of St. Luke, and the Ships and Navigation of the Antients. By James Smith, Esq. of Jordan Hill, F.R.S. 8vo. with Views, Charts, and Woodcuts, 14s. cloth.

SOAMES.—THE LATIN CHURCH DURING ANGLO-SAXON

TIMES. By the Rev. Henry Soames, M.A., Editor of "Mosheim's Institutes of Ecclesiastical History." 8vo. 14s. cloth.

SOME PASSAGES FROM MODERN HISTORY.

By the Author of "Letters to My Unknown Friends," and "Twelve Years Ago." Fcp. 8vo. 6s. 6d. cloth.

Contents:—1. Catharine at the Battle of the Pruth; 2 The Death of Sir Philip Sidney; 3. Some Passages from "La Rentreé Glorieuse": 4. Maria Theresa at Presburg; 5. The English Column at the Battle of Fontenoy; 6. The Rainbow at Prague; 7. The Death of Gustavus Adolphus; 8. The Queen's Prayer; 9. The Execution of Louis XVI.; 10. The Sleep of Argyle.

THE SONG OF SONGS, WHICH IS SOLOMON'S.

From the Holy Scriptures. Being the Six Chapters of the Book of the Song of Solomon, richly illuminated, in the Missal Style, by Owen Jones. Elegantly bound in relievo leather. Imperial 16mo. 21s.

SONGS, MADRIGALS, AND SONNETS:

A Gathering of some of the most pleasant Flowers of Old English Poetry. Set in borders of coloured Ornaments and Vignetts. Square fcp. 8vo. 10s. 6d. ornamental boards; or 17s. bound in morocco by Hayday.

ROBERT SOUTHEY'S COMPLETE POETICAL WORKS;

Containing all the Author's last Introductions and Notes. Complete in One Volume, with Portrait and View of the Poet's Residence at Keswick, uniform with Byron's and Moore's Poems. 8vo. 21s. cloth; or 42s. bound in morocco.

⁂ Also, an Edition in 10 vols. fcp. 8vo. with Portrait and 19 Plates, £2. 10s. cloth; bound in morocco, £4. 10s.

SOUTHEY.—SELECT WORKS OF THE BRITISH POETS,

From Chaucer to Withers. With Biographical Sketches, by R. Southey, LL.D. 8vo. 30s. cloth; with gilt edges, 31s. 6d.

SOUTHEY.—THE LATE MR. SOUTHEY'S COMMON-PLACE

BOOK. Edited by his Son-in-Law, the Rev. John Wood Warter. First Series, comprising CHOICE PASSAGES, Moral, Religious, Political, Philosophical, Historical, Poetical, and Miscellaneous; and COLLECTIONS for the History of Manners and Literature in England. Forming a volume complete in itself. With a medallion Portrait of Southey. Square crown 8vo. 18s. cloth.

"Such a collection of 'Choice Passages' we have never previously met with. They are drawn from works of all classes, and from every age of our literature, and bespeak an acquaintance, at once minute and comprehensive, with the whole range of English authorship. It is a book to be taken up for the hour, and the more frequently its companionship is sought the higher will be the opinion formed of its vast treasures. An ample Index is happily supplied, which serves the purpose of a skilful guide in what would otherwise be a trackless though rich wilderness. The literateur and the general reader will be alike gratified by its pages, in which wit and logic, humour and grave discourse, poetry and science, the facts of history and the lessons of philosophy, are happily mingled in due proportions."—Eclectic Review.

⁂ The Second Series, being SPECIAL COLLECTIONS, is *in the press.*

SOUTHEY.—THE LIFE AND CORRESPONDENCE OF THE

LATE ROBERT SOUTHEY. Edited by his Son, the Rev. Charles Cuthbert Southey, M.A. Post 8vo. [*In the press.*

SOUTHEY.—THE DOCTOR, &c.

By the late Robert Southey. Complete in One Volume. Edited by the Author's Son-in-Law, the Rev. John Wood Warter. With Portrait, Vignette Title-page, and Bust of the Author. New Edition. Square crown 8vo. 21s. cloth.

SOUTHEY.—THE LIFE OF WESLEY;

And Rise and Progress of Methodism. By Robert Southey, Esq. LL.D. New Edition, with Notes by the late Samuel Taylor Coleridge, Esq., and Remarks on the Life and Character of John Wesley, by the late Alexander Knox, Esq. Edited by the Rev. Charles Cuthbert Southey, A.M. Curate of Cockermouth. 2 vols. 8vo. with 2 Portraits, 28s. cloth.

STABLE TALK AND TABLE TALK;

or, SPECTACLES for YOUNG SPORTSMEN. By Harry Hieover. New Edition. 2 vols. 8vo. with Portrait, 24s. cloth.

STEEL'S SHIPMASTER'S ASSISTANT;

Compiled for the use of Merchants, Owners and Masters of Ships, Officers of Customs, and all Persons connected with Shipping or Commerce: containing the Law and Local Regulations affecting the Ownership, Charge, and Management of Ships and their Cargoes; together with Notices of other Matters, and all necessary Information for Mariners. New Edition, rewritten throughout. Edited by Graham Willmore, Esq. M.A. Barrister-at-Law; George Clements, of the Customs, London; and William Tate, Author of "The Modern Cambist." 8vo. 28s. cloth; or, 29s. bound.

STEPHEN.—ESSAYS IN ECCLESIASTICAL BIOGRAPHY.

By the Right Hon. Sir James Stephen, K.C.B. 2 vols. 8vo. 24s. cloth.

"As a complete treasury of biography of men whose lives deserve to be known, we heartily recommend these volumes to all who can admire talent, love healthy reading, and are desirous, not only of rich amusement, but of being furnished with instruction worth the remembering." Church and State Gazette.

STEPHEN.—HISTORY OF THE EPISCOPAL CHURCH OF

SCOTLAND, from the Reformation to the Present Time. By Thomas Stephen, Author of "The Book of the Constitution," "Spirit of the Church of Rome," &c. 4 vols. 8vo. with 24 highly-finished Portraits engraved on steel, 32s. cloth.

STEPHENS.—A MANUAL OF BRITISH COLEOPTERA,

or, BEETLES: containing a Description of all the Species of Beetles hitherto ascertained to inhabit Great Britain and Ireland, &c. With a Complete Index of the Genera. By J. F. Stephens, F.L.S. Author of "Illustrations of Entomology." Post 8vo. 14s. cloth.

THE STUD, FOR PRACTICAL PURPOSES AND PRACTICAL

MEN: being a Guide to the Choice of a Horse for use more than for show. By Harry Hieover, Author of "Stable Talk and Table Talk." Uniform with the "The Pocket and the Stud." With Two Plates, one representing "A pretty good sort for most purposes;" the other "'Raythe' a bad sort for any purpose." Fcp. 8vo. 5s. half-bound.

"A useful guide, not only to the practised buyer and seller of horse flesh, but to a person who intends to be a purchaser only on some special occasions. It will guard him against many a fraud, if it does not quite put him up to the good points; and after the perusal of this little volume it would be difficult for the knowing ones to take him in. Before buying a horse, therefore, we would advise all our readers to procure and peruse this volume: they will save the cost ten times over in the bargain." Critic.

THE SUITOR'S INSTRUCTOR IN THE PRACTICE OF THE

COUNTY COURTS: containing all the Information necessary for Conducting or Defending a Suit; the Fees payable on each Step; Definitions of the Legal Terms used in the Proceedings; an Abstract of the Act of Parliament; the Rules of Practice, &c. &c. Also, a District Directory, giving the Names of all the Streets (and the number of Houses in each Street) which form the Boundaries of the Metropolitan Districts, made from an actual Perambulation around each; and a List of the Country Districts. By a County Court Assistant Clerk. 12mo. 4s. 6d. cloth.

SWAIN.—ENGLISH MELODIES.

By Charles Swain, Author of "The Mind, and other Poems." Fcp. 8vo. 6s. cloth.

"A volume of lyrics which will be read with avidity....The diversity of subjects—the harmony of rhythm—the feeling and kindliness of heart—the pathos manifested—must render this book deservedly popular. There is in numbers of the songs a striking originality that cannot fail to charm the reader and rivet his attention." Sunday Times.

TATE.—THE CONTINUOUS HISTORY OF THE LIFE AND

WRITINGS OF ST. PAUL, on the basis of the Acts; with Intercalary Matter of Sacred Narrative, supplied from the Epistles, and elucidated in occasional Dissertations: with the Horæ Paulinæ of Dr. Paley, in a more correct edition, subjoined. By James Tate, M.A. Canon Residentiary of St. Paul's. 8vo. with Map, 13s. cloth.

TAYLER.—MARGARET;

Or, the Pearl. By the Rev. Charles B. Tayler, M.A. Rector of St. Peter's, Chester, Author of "Lady Mary; or, Not of the World," &c. New Edition. Fcp. 8vo. 6s. cloth.

TAYLER.—LADY MARY;

Or, Not of the World. By the Rev. Charles B. Tayler, Rector of St. Peter's, Chester; Author of "Margaret, or the Pearl," &c. New Edition, with a Frontispiece engraved by J. Absolon. Fcp. 8vo. 6s. 6d. cloth.

TAYLOR.—LOYOLA: AND JESUITISM IN ITS RUDIMENTS.

By Isaac Taylor, Author of "Natural History of Enthusiasm," &c. Post 8vo. 10s. 6d. cloth.

"Various books on individual Jesuits, or on the constitutions of their order, have lately appeared, but nothing at all approaching in interest or merit to *Loyola: and Jesuitism in its Rudiments*. . . . a book that must be carefully read by any one who wishes to form a true idea of Loyola, and an idea of Jesuitism."—Spectator.

"Mr. Taylor has thrown together, with the powerful grasp of his mind, the principal events and circumstances which gave rise to the institution of the Jesuit order, and sketched out the character of its founder with a masterly hand. After all the trash that has been written on the subject of late, it is refreshing to turn over the pages of a work in which the subject is handled with the dignity and severity of truth which its importance and the character of history alike demand."

John Bull.

THIRLWALL.—THE HISTORY OF GREECE.

By the Right Rev. the Lord Bishop of St. David's (the Rev. Connop Thirlwall). A New Edition, revised; with Notes. Vols. I. to V. 8vo. with Maps, 36s. cloth. To be completed in 8 volumes, price 12s. each. [*Vol. VI. nearly ready.*

"We are glad to receive another volume of this edition of Bishop Thirlwall's 'History,' and are quite satisfied, on an inspection of its contents, at the delay which has occurred in its appearance. The work is one of which English scholarship may well be proud—uniting sound erudition with elegant taste, an intimate knowledge of the sources of Greek history, with a discriminating judgment, and a very felicitous style of composition. Having repeatedly expressed our opinion on its merits, we shall not now make any attempt at elaborate criticism.... We know of no classical history which, as a whole, is so entitled to approval and admiration. Bishop Thirlwall has evidently spared no pains to perfect the work, and he will have his reward in the permanent hold it must take on the public mind.... The present work is up to the requirements of the scholarship of the day. It is erudite without being dry, and liberal without scepticism. It bespeaks the learning of a scholar and the manners of a gentleman, and constitutes a record of the past, from which the student and the philosopher of our day may gain an instructive insight into the character and institutions of the Greeks."

Eclectic Review.

***** Also, an Edition in 8 vols. fcp. 8vo. with Vignette Titles, £2. 8s. cloth.**

THOMSON'S SEASONS.

Edited by Bolton Corney, Esq. Illustrated with Seventy-seven Designs drawn on Wood, by Members of the Etching Club. Engraved by Thompson and other eminent Engravers. Square crown 8vo. uniform with "Goldsmith's Poems," 21s. cloth; or, bound in morocco, by Hayday, 36s.

THOMSON'S SEASONS.

Edited, with Notes, Philosophical, Classical, Historical, and Biographical, by Anthony Todd Thomson, M.D. F.L.S. Fcp. 8vo. 7s. 6d. cloth.

THOMSON.—THE DOMESTIC MANAGEMENT OF THE SICK

ROOM, necessary, in Aid of Medical Treatment, for the Cure of Diseases. By Anthony Todd Thomson, M.D. F.L.S. Professor of Materia Medica and Therapeutics, and of Forensic Medicine, in University College, London. New Edition. Post 8vo. 10s. 6d. cloth.

THOMSON.—TABLES OF INTEREST,

At Three, Four, Four-and-a-Half, and Five per Cent., from One Pound to Ten Thousand, and from One to Three Hundred and Sixty-five Days, in a regular progression of single Days; with Interest at all the above Rates, from One to Twelve Months, and from One to Ten Years. Also, numerous other Tables of Exchanges, Time, and Discounts. By John Thomson, Accountant. New Edition. 12mo. 8s. bound.

THOMSON.—SCHOOL CHEMISTRY;

Or, Practical Rudiments of the Science. By Robert Dundas Thomson, M.D. Master in Surgery in the University of Glasgow; Lecturer on Chemistry in the same University; and formerly in the Medical Service of the Honourable East India Company. Fcp. 8vo. with Woodcuts, 7s. cloth.

THOMSON.—EXPERIMENTAL RESEARCHES ON THE FOOD

of ANIMALS and the FATTENING of CATTLE: with Remarks on the Food of Man. By Robert Dundas Thomson, M.D. Author of "School Chemistry; or, Practical Rudiments of the Science." Fcp. 8vo. 5s. cloth.

THE THUMB BIBLE;

Or, Verbum Sempiternum. By J. Taylor. Being an Epitome of the Old and New Testaments in English Verse. Printed from the Edition of 1693, by C. Whittingham, Chiswick. 64mo. 1s. 6d. bound and clasped.

TOMLINE.—AN INTRODUCTION TO THE STUDY OF THE

BIBLE: containing Proofs of the Authenticity and Inspiration of the Holy Scriptures; a Summary of the History of the Jews; an Account of the Jewish Sects; and a brief Statement of the Contents of the several Books of the Old and New Testaments. By George Tomline, D.D. F.R.S. New Edition Fcp. 8vo. 5s. 6d. cloth.

TOOKE.—THE HISTORY OF PRICES:

With reference to the Causes of their principal Variations, from the year 1792 to the year 1838, inclusive. Preceded by a Sketch of the History of the Corn Trade in the last Two Centuries. By THOMAS TOOKE, Esq. F.R.S. 3 vols. 8vo. £2. 8s. cloth.

TOOKE.—THE HISTORY OF PRICES, AND OF THE STATE

of the CIRCULATION from 1839 to 1847, inclusive: with a general Review of the Currency Question, and Remarks on the Operation of the Acts 7 and 8 Vict. c. 32: being a continuation of "The History of Prices, from 1792 to 1838." By T. TOOKE, Esq. F.R.S. 8vo. 18s. cloth.

TOWNSEND.—THE LIVES OF TWELVE EMINENT JUDGES

of the LAST and of the PRESENT CENTURY. By W. CHARLES TOWNSEND, Esq. M.A. Recorder of Macclesfield; Author of "Memoirs of the House of Commons." 2 vols. 8vo. 28s. cloth.

TURNER.—THE HISTORY OF ENGLAND,

From the Earliest Period to the Death of Elizabeth. By SHARON TURNER, Esq. F.A.S. R.A.S.L. New Editions. 12 vols. 8vo. £8. 3s. cloth.—Or, separately,

THE HISTORY of the ANGLO-SAXONS. 3 vols. 8vo. £2. 5s. boards.
THE HISTORY of ENGLAND during the MIDDLE AGES. 5 vols. 8vo. £3, bds.
THE HISTORY of the REIGN of HENRY VIII. 2 vols. 8vo. 26s. boards.
THE REIGNS of EDWARD VI., MARY, and ELIZABETH. 2 vols. 8vo. 32s. bds.

TURNER.—THE SACRED HISTORY OF THE WORLD,

Attempted to be Philosophically considered, in a Series of Letters to a Son. By SHARON TURNER, F.S.A. and R.A.S.L. New Edition, edited by the Rev. SYDNEY TURNER. 3 vols. post 8vo. 31s. 6d. cloth.

DR. TURTON'S MANUAL OF THE LAND AND FRESH-

WATER SHELLS of the BRITISH ISLANDS. A New Edition, thoroughly revised and with considerable Additions. By JOHN EDWARD GRAY, Keeper of the Zoological Collection in the British Museum. Post 8vo. with Woodcuts, and 12 Coloured Plates 15s. cloth.

TWELVE YEARS AGO: A TALE.

By the Author of "Letters to my Unknown Friends." Fcp. 8vo. 6s. 6d. cloth.

TWINING.—ON THE PHILOSOPHY OF PAINTING:

A Theoretical and Practical Treatise; comprising Æsthetics in reference to Art—the Application of Rules to Painting—and General Observations on Perspective. By H. TWINING, Esq. Imperial 8vo. with numerous Plates and Wood Engravings, 21s. cloth.

URE.—DICTIONARY OF ARTS, MANUFACTURES, & MINES;

Containing a clear Exposition of their Principles and Practice. By ANDREW URE, M.D. F.R.S. M.G.S. M.A.S. Lond.; M. Acad. N.L. Philad.; S. Ph. Soc. N. Germ. Hanov.; Mulii. &c. &c. New Edition, corrected. 8vo. with 1,240 Engravings on Wood, 50s. cloth.—Also,

SUPPLEMENT of RECENT IMPROVEMENTS. New Edition. 8vo. with Woodcuts, 14s. cloth.

VON ORLICH.—TRAVELS IN INDIA;

Including Scinde and the Punjab, in 1842 and 1843. By Capt. LEOPOLD VON ORLICH. Translated from the Germna, by H. EVANS LLOYD, Esq. 2 vols. 8vo. with coloured Frontispieces, and numerous Illustrations on Wood, 25s. cloth.

WALFORD.—THE LAWS OF THE CUSTOMS,

Compiled by Direction of the Lords Commissioners of Her Majesty's Treasury, and published under the Sanction of the Commissioners of Her Majesty's Customs; with Notes and a General Index. Edited by J. G. WALFORD, Esq. Solicitor for the Customs. 8vo. 10s. 6d. cloth.

WALKER.—CHESS STUDIES;

Comprising One Thousand Games of Chess, as really played by the first Chess Players; forming a complete Encyclopædia of Reference, and presenting the greatest Collection extant of fine specimens of strategy in every stage of the Game. Selected and arranged by GEORGE WALKER, Author of "Chess made Easy," &c. 8vo. 10s. 6d. sewed.

WALKER.—ELEMENTA LITURGICA;

Or, the Churchman's Mirror, for the Scholastic Study of the Book of Common Prayer. By G. A. Walker, A.M., of Christ College, Cambridge. New Edition, entirely rearranged and considerably enlarged. Fcp. 8vo. 4s. 6d. cloth.

WARDLAW.—DISCOURSES ON THE PRINCIPAL POINTS

OF THE SOCINIAN CONTROVERSY—the Unity of God, and the Trinity of Persons in the Godhead; the Supreme Divinity of Jesus Christ; the Doctrine of the Atonement; the Christian Character, &c. By Ralph Wardlaw, D.D. New Edition, 8vo. 15s. cloth.

WATERTON.—ESSAYS ON NATURAL HISTORY,

Chiefly Ornithology. By Charles Waterton, Esq., Author of "Wanderings in South America." With an Autobiography of the Author, and Views of Walton Hall. New Edition. 2 vols. fcp. 8vo. 14s. 6d. cloth.

*** Separately—Vol. I. (First Series), 8s.; Vol. II. (Second Series), 6s. 6d.

WEBSTER.—AN ENCYCLOPÆDIA OF DOMESTIC ECONOMY;

Comprising such subjects as are most immediately connected with Housekeeping: as, The Construction of Domestic Edifices, with the modes of Warming, Ventilating, and Lighting them—A description of the various articles of Furniture, with the nature of their Materials—Duties of Servants, &c. &c. &c. By Thomas Webster, F.G.S.; assisted by the late Mrs. Parkes. New Edition. 8vo. with nearly 1,000 Woodcuts, 50s. cloth.

WESTWOOD.—AN INTRODUCTION TO THE MODERN

CLASSIFICATION OF INSECTS; founded on the Natural Habits and compounding Organisation of the different Families. By J. O. Westwood, F.L S. &c. &c. &c. 2 vols. 8vo. with numerous Illustrations, £2. 7s. cloth.

WILBERFORCE.—A PRACTICAL VIEW OF THE PREVAILING

RELIGIOUS SYSTEMS of PROFESSED CHRISTIANS, in the Higher and Middle Classes in this Country, contrasted with Real Christianity. By Wm. Wilberforce, Esq. M.P. New Edition. 8vo. 8s. boards.—Also, an Edition in fcp. 8vo. price 4s. 6d. cloth.

LADY WILLOUGHBY'S DIARY.

So much of the Diary of Lady Willoughby as relates to her Domestic History, and to the Eventful Period of King Charles the First, the Protectorate, and the Restoration (1635 to 1663). Printed, ornamented, and bound in the style of the period to which *The Diary* refers. New Edition. In Two Parts. Square fcp. 8vo. 8s. each, boards; or 18s. each, bound in morocco by Hayday.

WILSON.—THE LANDS OF THE BIBLE VISITED AND

DESCRIBED, in an Extensive Journey undertaken with special reference to the promotion of Biblical Research and the advancement of the Cause of Philanthropy. By John Wilson, D.D. F.R.S. Honorary President of the Bombay Branch of the Royal Asiatic Society, &c. 2 vols. 8vo. with Maps and numerous Illustrations, £1. 16s. cloth.

WOOD.—A PRACTICAL TREATISE ON RAILROADS,

And Interior Communication in General; containing numerous Experiments on the Powers of the Improved Locomotive Engines, and Tables of the comparative Cost of Conveyance on Canals, Railways, and Turnpike Roads. By Nicholas Wood, Memb. Inst. Civ. Eng. &c. New Edition. 8vo. with Plates and Woodcuts, 31s. 6d. cloth.

WOODCOCK.—SCRIPTURE LANDS:

Being a Visit to the Scenes of the Bible. By the Rev. W. J. Woodcock, St. Agnes, Nassau, New Providence. With 4 coloured Plates. Post 8vo. 10s. 6d. cloth.

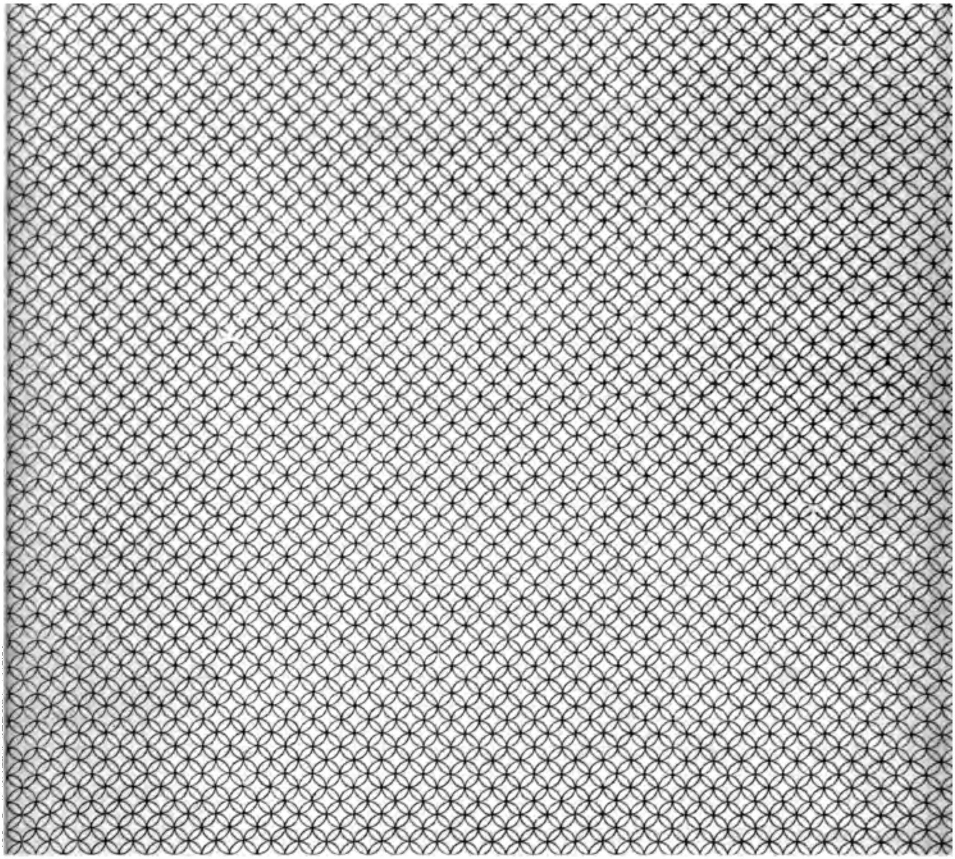
"This is a very entertaining journal. The author landed at Beyrout, and passing through Damascus and Tiberias to Jerusalem, from thence diverged to the most remarkable places in the Holy Land To those who take an interest in the present circumstances of Judæa we can safely recommend this volume. The author's views of the traditions of the holy places are quite those which we should take ourselves." British Magazine.

ZUMPT'S GRAMMAR OF THE LATIN LANGUAGE.

Translated and adapted for the use of English Students, with the Author's sanction and co-operation, by Dr. L. Schmitz, F.R.S.E., Rector of the High School of Edinburgh: with copious Corrections and Additions communicated to Dr. Schmitz, for the authorised English Translation, by Professor ZUMPT. New Edition, corrected. 8vo. 14s. cloth.

[*September* 30, 1849.

WILSON AND OGILVY, SKINNER STREET, SNOWHILL, LONDON.



WORKS IN GENERAL LITERATURE.

I.

THE late Mr. SOUTHEY's COMMONPLACE-BOOK. Edited by the Rev. J. W. Warter. Square crown 8vo. 18s.

II.

SOUTHEY's The DOCTOR, &c. Complete in One Vol. Edited by the Rev. J. W. Warter. Sq. cr. 8vo. Portrait, &c. 21s.

III.

SOUTHEY's POETICAL WORKS. Complete in One Volume; with Portrait and Vignette. 8vo. 21s.; morocco, 42s.

IV.

THOMAS MOORE's POETICAL WORKS. Complete in One Volume; with Portrait and Vignette. 8vo. 21s.; morocco, 42s.

V.

SIR J. STEPHEN's ESSAYS in ECCLESIASTICAL BIOGRAPHY, &c. contributed to the Edinburgh Review. 2 vols. 24s.

VI.

SIR J. MACKINTOSH's MISCELLANEOUS WORKS: including his Contributions to the Edinburgh Review. 3 vols. 8vo. 42s.

VII.

FRANCIS LORD JEFFREY's CONTRIBUTIONS to the EDINBURGH REVIEW. New Edition. 3 vols. 8vo. 42s.

VIII.

THE Rev. SYDNEY SMITH's WORKS: including his Contributions to the Edinburgh Review. New Edition. 3 vols. 8vo. Portrait, 36s.

IX.

THE HISTORY of ENGLAND, from the Accession of James II. By Thomas Babington Macaulay. New Edition. Vols. I. and II. 8vo. 32s.

X.

MR. MACAULAY's CRITICAL and HISTORICAL ESSAYS, contributed to the Edinburgh Review. New Edition. 3 vols. 8vo. 36s.

XI.

MR. MACAULAY's LAYS of ANCIENT ROME. Illustrated, chiefly from the Antique, by G. Scharf, Jun. Fcp. 4to. Woodcuts, 21s.; morocco, 42s.

XII.

MR. MACAULAY's LAYS of ANCIENT ROME: with "Ivry" and "The Armada." 16mo. Vignette, 4s. 6d.; morocco, 10s. 6d.

London: Longman, Brown, Green, and Longmans.

IND BY